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ABSTRACT

A description of current activities in instructional computing in Washington State community colleges is presented, along with curriculum content guidelines and planning procedures to assist colleges which plan to initiate or upgrade their activities in instructional computing. The document provides an overview of computing activities in the entire system and profiles 28 individual colleges, describing courses that are directly related to computing, such as data processing and computer science, and courses that use computing in an ancillary fashion, such as those that use computer-based instruction, computer-managed instruction, and computer-assisted instruction. A description of resources and equipment maintained by each college is provided. A section on planning procedures outlines curriculum objectives and typical content for instructional courses which require access to computing facilities; and describes software, hardware, personnel, and other requirements necessary to meet stated course objectives. The final section presents resource specifications and acquisition procedures, including examples of cost analyses and cost summaries, which will permit the colleges to move from their present level of instructional computing to a more advanced level in a phased growth manner. A glossary of terms and a bibliography conclude the document. (DR)

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ED172891

# INSTRUCTIONAL COMPUTING IN THE COMMUNITY COLLEGES OF WASHINGTON STATE

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JUNE 1978

U.S. DEPARTMENT OF HEALTH EDUCATION & WELFARE NATIONAL INSTITUTE OF EDUCATION

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JC 790 441

STATE OF WASHINGTON
State Board for Community College Education

# FOREWORD

This publication is intended to serve essentially two purposes. The first is to provide a description of current activities in instructional computing in the community colleges of Washington State. The second is to provide curriculum content guidelines and planning procedures to assist those colleges which are planning to initiate or upgrade their activities in instructional computing. By providing systemwide information and perspective, it is anticipated that the document will serve as a tool of communication between the colleges, as well as providing support documentation for equipment and budget requests. The document is also intended to satisfy, for the instructional computing area, the planning and information requirements established by the Washington State Data Processing Authority.

The information was compiled through a joint effect between the Instructional Computing Resource Monitoring Group (ICRMG) and the State Board for Community College Education. Those individuals who contributed are as follows:

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# CURRENT ACTIVITIES AND RESOURCES

# INTRODUCTION

The "Current Activities and Resources" chapter presents a profile of instructional computing activities in the community college system as a whole, and then individual profiles of information for each of the colleges. The activities described include those courses which use computing either directly or indirectly. The resources described include computing equipment or computing services utilized by the courses. Also, planned instructional computing activity information is included on the individual college profiles, if applicable.

As stated, there are two types of courses that are addressed: those that are directly related to computing, and those that use computing in an ancillary fashion. Courses that are directly related to computing include:

(1) Data processing technology courses that teach skills for data processing positions such as computer programming, micro-processor programming, computer operating, or data entry. These courses may lead to degrees or certificates in data processing. There are currently thirteen approved vocational data processing training programs in the community college system;

(2) Data processing survey or introduction courses that provide knowledge of data processing concepts for students in all areas of study;

(3) Computer science courses that deal with computing theory and provide background for computer science majors; and,

(4) Courses that teach computing techniques for problem solving such as the FORTRAN or BASIC programming languages.

Courses that use computing in an ancillary fashion include:

(1) Computer-Based Instruction (CBI) which is the use of specialized computer programs such as models, simulators, and emulators as tools to support the instruction of traditional disciplines such as economics, business or engineering;

(2) Computer-Managed Instruction (CMI) applications which are used to effect or organize steps in the instructional process such as testing, performance evaluation, or prescription of course modules;

(3) Computer-Assisted Instruction (CAI) applications which are designed to drill or teach students through direct student/program interaction; and,

(4) Courses that utilize the computer as a problem-solving tool when students are knowledgeable in the use of a problem-solving programming language such as FORTRAN or BASIC.

Two types of resources are addressed: computing equipment and computing services. The equipment is categorized as follows:

(1) On-site computing devices;

(2) Hi-speed RJE to host;

(3) Lo-speed terminal to remote;

(4) Data entry;

(5) Unit record; and,

(6) Off-campus/off-line resource.

Computing services include computing support purchased from one of the state data processing service centers or other organizations or institutions which provide it. The two state centers designated for instructional computing are the Washington State University Computer Center (WSUCC), and the Washington Interactive Computer Service (TWICS) at Eastern Washington University. Other sources being utilized include The Evergreen State College and the University of Washington.

# SYSTEM PROFILE

## COMMUNITY COLLEGE INSTRUCTIONAL COMPUTING CONTACTS

| COLLEGE | CONTACT | SCAN NUMBER |
|---|---|---|
| Peninsula | Ted Graves | 227-1011 |
| Grays Harbor | Ed Ackerson | 433-1011 |
| Olympic | Harlan Tormenen | 356-4511 |
| Skagit Valley | Bob Batterberry | 326-0011 |
| Everett | Gordon Kimble | 474-1011 |
| Edmonds | Gary Isham | 241-0280 |
| Seattle Central | Dee Stark | 432-4151 |
| North Seattle | George Miller | 446-4437 |
| South Seattle | Reuben Krogstad | 628-5300 |
| Shoreline | Howard Hubbard | 274-1011 |
| Bellevue | Lynn Tooley | 334-0111 |
| Highline | Art Massey | 374-1011 |
| Green River | Bob Christiansen | 254-1323 |
| Ft. Steilacoom | Jim Richardson | 346-6645 |
| Centralia | Alice Forth | 234-3433 |
| Olympia Technical | Frankie Schlenker | 234-3000 |
| Garrett Heyns | Fred Mueller | 276-1329 |
| Lower Columbia | Alan Howard | 239-2348 |
| Clark | Jim Cowen | 534-1011 |
| Wenatchee Valley | Ron Baker | 241-2640 |
| Yakima Valley | Doug Nielson | 558-2350 |
| Spokane | Walt Wittstruck | 271-1200 |
| Spokane Falls | Nick Nickoloff | 545-6302 |
| Big Bend | George Champie | 664-1011 |
| Columbia Basin | Jewel Smith | 563-1011 |
| Walla Walla | Bob Denning | 736-4247 |
| Whatcom | Nate Smothers | 738-2170 |
| Tacoma | Ed Zimmerman | 548-5070 |

# WASHINGTON COMMUNITY COLLEGE SYSTEM

*INSTRUCTIONAL COMPUTING: RESOURCE UTILIZATION*

| COMMUNITY COLLEGE | ANNUAL FTE STUDENTS 1976-77 | ON-SITE COMPUTING DEVICES | | | | HI-SPEED RJE'S | | LO-SPEED TERMINALS | | DATA ENTRY | UNIT RECORD | FY 1978 EQUIPMENT & SERVICES BUDGET |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Maxi | Mini | Micro | Programmable Calculator | Quantity | Host(s) | Quantity | Host(s) | | | |
| PENINSULA | 1,142 | -- | -- | -- | 1 | -- | -- | 1 | TWICS | -- | -- | $ 3,000 |
| GRAYS HARBOR | 1,363 | -- | -- | -- | 1 | 1 | WSUCC | -- | -- | 7 | -- | 19,219 |
| OLYMPIC | 3,605 | -- | -- | -- | 1 | 1 | WSUCC | 2 | TESC | 10 | 1 | 33,886 |
| SKAGIT VALLEY | 2,565 | 2 | 2 | 3 | -- | -- | -- | 5 | LOCAL | -- | -- | 6,100 |
| EVERETT | 4,207 | -- | -- | 1 | -- | -- | -- | 8 | ESD 189 | -- | -- | 13,912 |
| EDMONDS | 2,483 | 1 | 1 | 1 | -- | -- | -- | 6 | LOCAL | 1 | -- | 3,400 |
| SEATTLE CENTRAL | 5,740 | -- | 1 (2) | -- | -- | 1 (2) | WSUCC | 10 | LOCAL | 24 | 5 | 26,066 |
| NORTH SEATTLE | 3,540 | 1 | -- | 10 | -- | -- | -- | 20 | LOCAL | 1 | -- | 8,500 |
| SOUTH SEATTLE | 2,637 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| SHORELINE | 4,745 | -- | 1 | -- | 1 | -- | -- | 12 | LOCAL | -- | -- | 760 |
| BELLEVUE | 4,125 | -- | -- | -- | 1 | -- | -- | 5 | LOCAL | -- | -- | 8,500 (1) |
| HIGHLINE | 4,559 | 1 | -- | -- | -- | -- | -- | 6 | LOCAL | 13 | 4 | 49,896 (1) |
| GREEN RIVER | 3,765 | -- | -- | -- | -- | -- | -- | 5 | TESC, WSU | -- | -- | 5,200 |
| FORT STEILACOOM | 5,659 | -- | -- | 1 | -- | 1 | WSUCC | 2 | WSU | 4 | 1 | 12,240 |
| CENTRALIA | 1,963 | -- | -- | -- | -- | -- | -- | 2 | TESC | 11 | -- | 35,276 |
| OTCC | 1,423 | 1 (2) | -- | -- | -- | 1 (2) | WSUCC | 4 | WSU, TESC | 16 | -- | 82,328 |
| GARRETT HEYNS | 426 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1,800 |
| LOWER COLUMBIA | 2,167 | -- | -- | 2 | -- | 2 | WSUCC | 14 | TESC, TWICS | 11 | -- | 24,892 (1) |
| CLARK | 3,628 | 2 | 1 | 1 | -- | -- | -- | 18 | LOCAL | 15 | 4 | 26,100 |
| WENATCHEE VALLEY | 1,903 | -- | -- | -- | -- | -- | -- | 1 | WSU | -- | -- | 2,740 |
| YAKIMA VALLEY | 3,118 | -- | -- | -- | -- | 1 | WSUCC | -- | -- | 1 | 2 | 300 |
| SPOKANE | 5,954 | 1 | 1 | -- | -- | -- | -- | 1 | LOCAL, TWICS | 28 | 3 | 43,160 |
| SPOKANE FALLS | 5,951 | -- | -- | -- | -- | -- | -- | 2 | LOCAL, TWICS, WSU, TESC | -- | -- | 12,000 |
| BIG BEND | 1,106 | -- | -- | 1 | -- | 1 | WSUCC | 1 | LOCAL | 4 | -- | 16,000 |
| COLUMBIA BASIN | 2,762 | 1 | -- | -- | -- | -- | -- | 1 | TWICS | 5 | 4 | 58,500 (1) |
| WALLA WALLA | 2,552 | -- | -- | -- | -- | -- | -- | -- | -- | 2 | -- | -- |
| WHATCOM | 813 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| TACOMA | 3,892 | -- | -- | -- | 1 | -- | -- | 6 | WSU, TWICS | 6 | -- | 17,266 |

(1) *Includes some administrative work* (2) *Same piece of equipment in two categories*

TWICS: The Washington Interactive Computer Services at Eastern Washington University
TESC: The Evergreen State College Computer Center
WSU: Washington State University Computer Center

## WASHINGTON COMMUNITY COLLEGE SYSTEM

*COURSES DIRECTLY RELATED TO COMPUTING:*
*NUMBER OF COURSES INDICATED IN EACH AREA*

| | DATA PROCESSING TECHNOLOGY | | | | DP Introduction or Survey | Computer Science | Problem Solving | Approved Vocational Program? |
|---|---|---|---|---|---|---|---|---|
| | Analyst/ Programming | Mini/Micro Computing | Operations | Data Entry | | | | |
| PENINSULA | -- | -- | -- | -- | 2 | -- | 1 | no |
| GRAYS HARBOR | 4 | -- | -- | 1 | 1 | -- | 1 | yes |
| OLYMPIC | 10 | -- | -- | 1 | 1 | -- | -- | yes |
| SKAGIT VALLEY | -- | -- | -- | -- | 1 | 5 | 4 | no |
| EVERETT | 14 | -- | -- | 1 | 1 | -- | 2 | yes |
| EDMONDS | -- | 4 | -- | -- | 1 | -- | 7 | no |
| SEATTLE CENTRAL | 16 | -- | 3 | 4 | 1 | -- | -- | yes |
| SEATTLE NORTH | 17 | -- | -- | -- | 1 | -- | -- | yes |
| SEATTLE SOUTH | -- | -- | -- | -- | 1 | -- | -- | no |
| SHORELINE | -- | -- | -- | -- | 1 | -- | 4 | no |
| BELLEVUE | -- | -- | -- | -- | -- | -- | 3 | no |
| HIGHLINE | 12 | -- | 1 | 2 | 3 | -- | -- | yes |
| GREEN RIVER | 2 | -- | -- | -- | 1 | -- | 1 | no |
| FORT STEILACOOM | 12 | -- | -- | -- | 2 | 2 | -- | yes |
| CENTRALIA | 3 | -- | -- | 1 | -- | -- | 2 | no |
| OTCC | 6 | -- | 1 | -- | 1 | -- | 2 | yes |
| GARRETT HEYNS | 3 | -- | -- | -- | -- | -- | -- | no |
| LOWER COLUMBIA | 13 | 1 | -- | 1 | 2 | -- | 1 | yes |
| CLARK | 21 | -- | 1 | 2 | 3 | 5 | -- | yes |
| WENATCHEE VALLEY | -- | -- | -- | -- | 1 | -- | 3 | no |
| YAKIMA VALLEY | -- | -- | -- | -- | 1 | -- | 2 | no |
| SPOKANE | 12 | -- | 1 | 7 | 2 | -- | -- | yes |
| SPOKANE FALLS | -- | -- | -- | -- | 1 | -- | 3 | no |
| BIG BEND | 8 | 1 | -- | 1 | 2 | 2 | -- | yes |
| COLUMBIA BASIN | 7 | -- | -- | -- | 2 | -- | 2 | yes |
| WALLA WALLA | -- | -- | -- | 3 | 1 | -- | -- | no |
| WHATCOM | -- | -- | -- | -- | 1 | -- | -- | no |
| TACOMA | -- | -- | -- | 1 | 1 | -- | 3 | no |

# WASHINGTON COMMUNITY COLLEGE SYSTEM

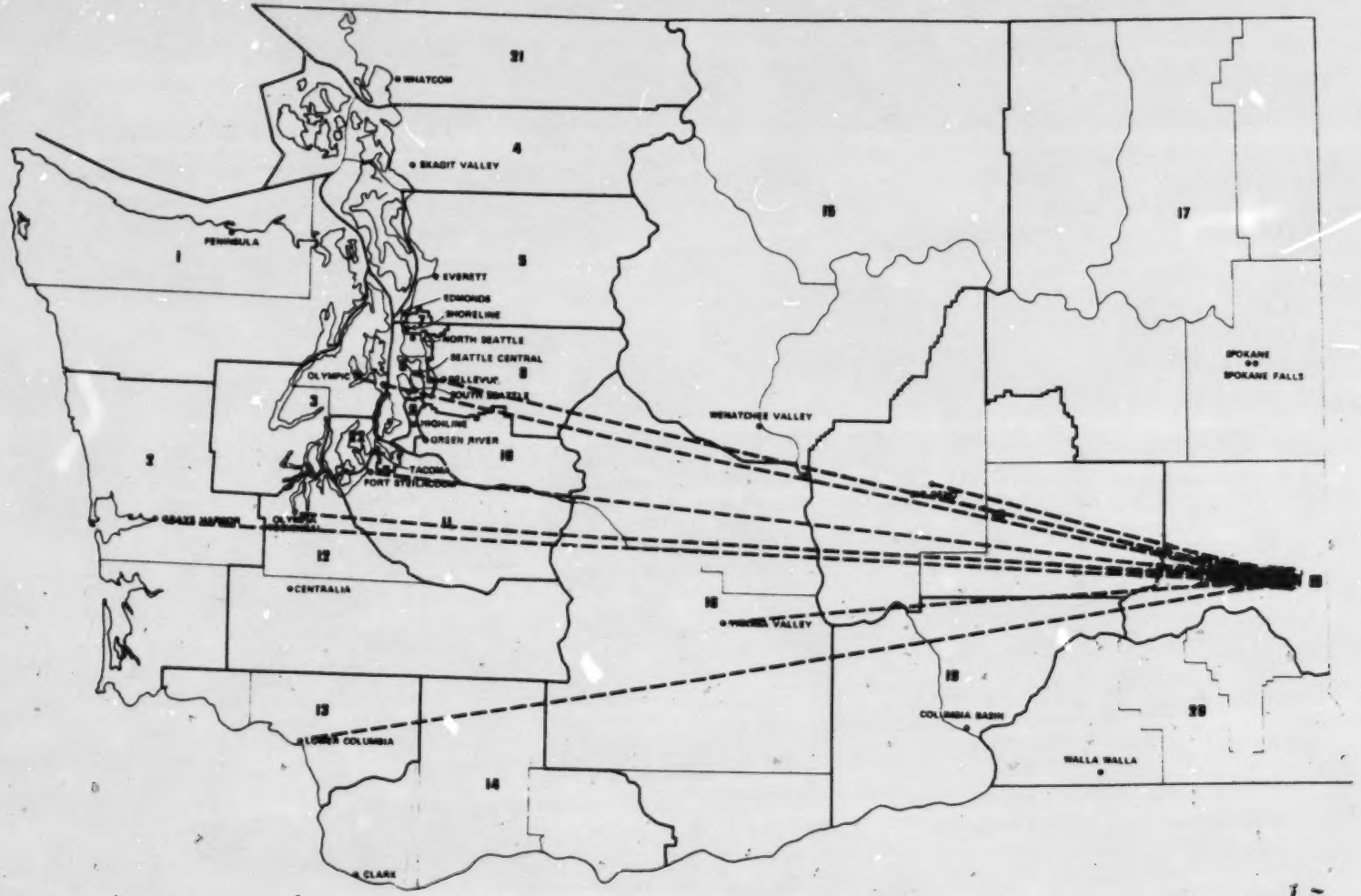
## COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| College | Number of Courses |
|---|---|
| Peninsula | 1 |
| Grays Harbor | - |
| Olympic | 1 |
| Skagit Valley | - |
| Everett | - |
| Edmonds | 15 |
| Seattle Central | 12 |
| Seattle North | 3 |
| Seattle South | 1 |
| Shoreline | 27 |
| Bellevue | 4 |
| Highline | - |
| Green River | - |
| Fort Steilacoom | - |
| Centralia | - |
| OTCC | - |
| Garrett Heyns | - |
| Lower Columbia | 7 |
| Clark | 5+ |
| Wenatchee Valley | - |
| Yakima Valley | - |
| Spokane | 1 |
| Spokane Falls | 18 |
| Big Bend | 2 |
| Columbia Basin | - |
| Walla Walla | - |
| Whatcom | - |
| Tacoma | 4 |

COMMUNITY COLLEGE INSTRUCTIONAL COMPUTING

Hi-Speed RJE Terminals to the Washington State University Computer Center

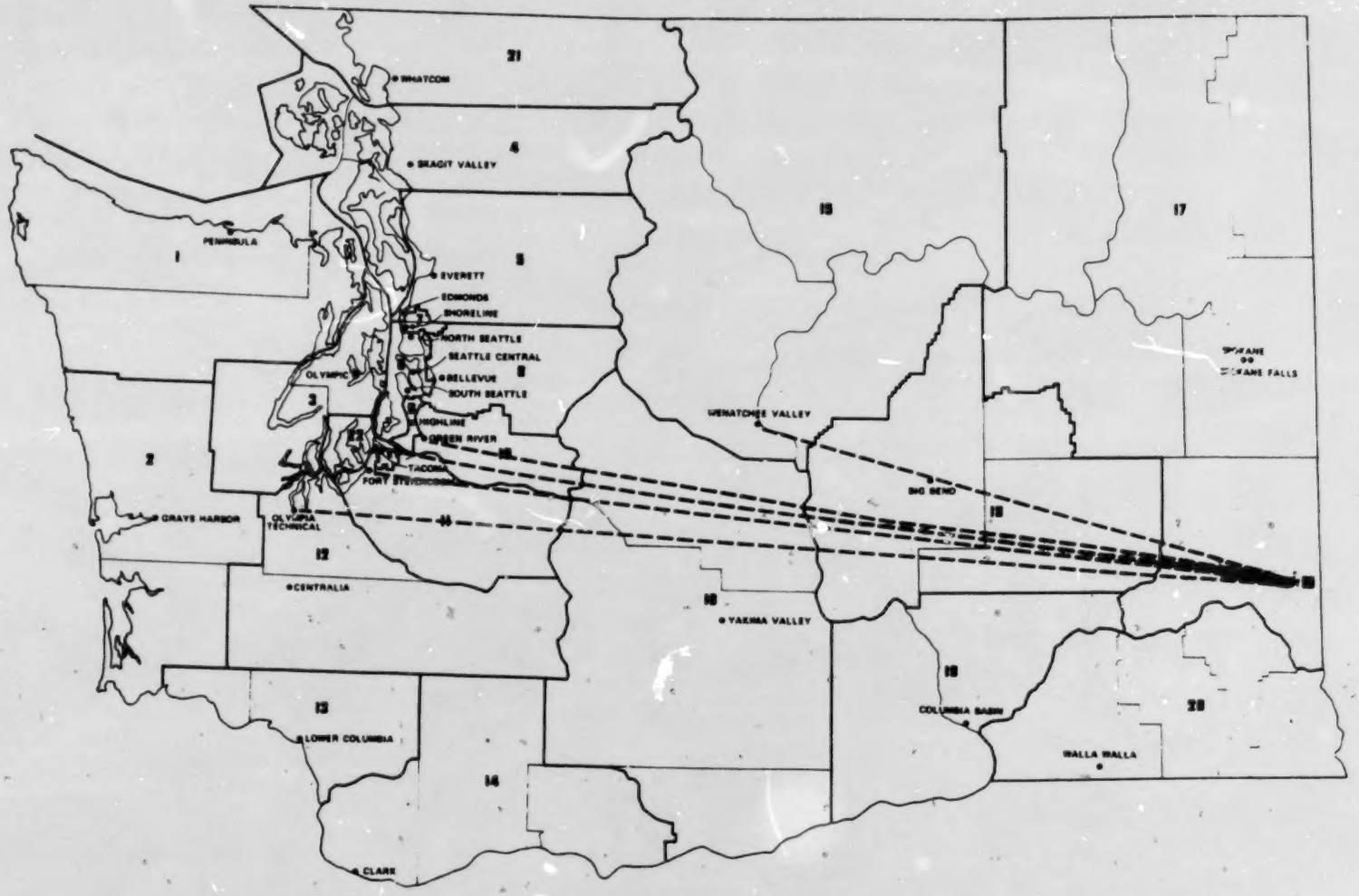
# The Washington Community College System



COMMUNITY COLLEGE INSTRUCTIONAL COMPUTING

Lo-Speed Terminal Connections to the Washington State University Computer Center

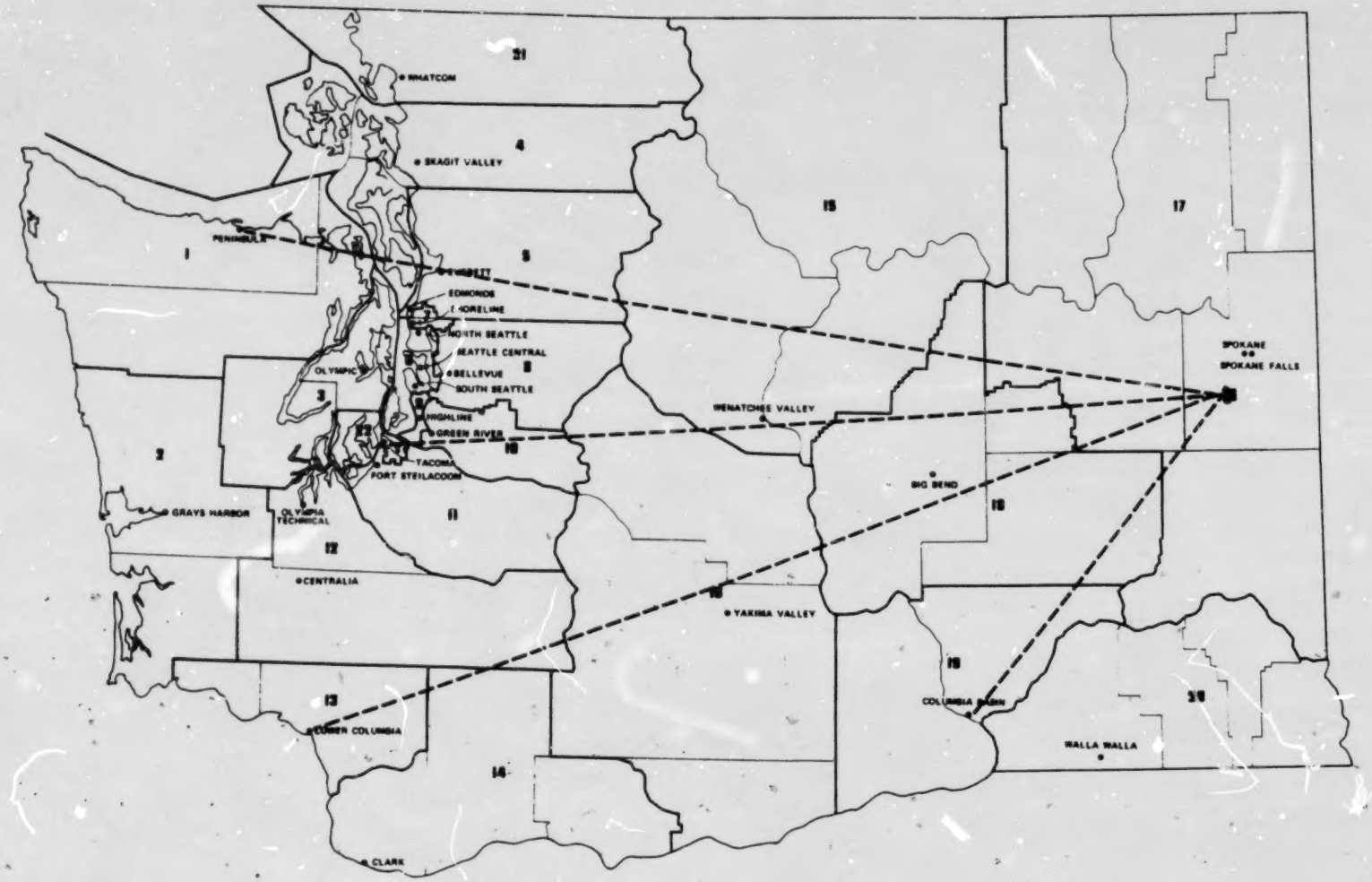
# The Washington Community College System



COMMUNITY COLLEGE INSTRUCTIONAL COMPUTING

Lo-Speed Terminal Connections to TWICS,
The Washington Interactive Computer Services to
Eastern Washington University

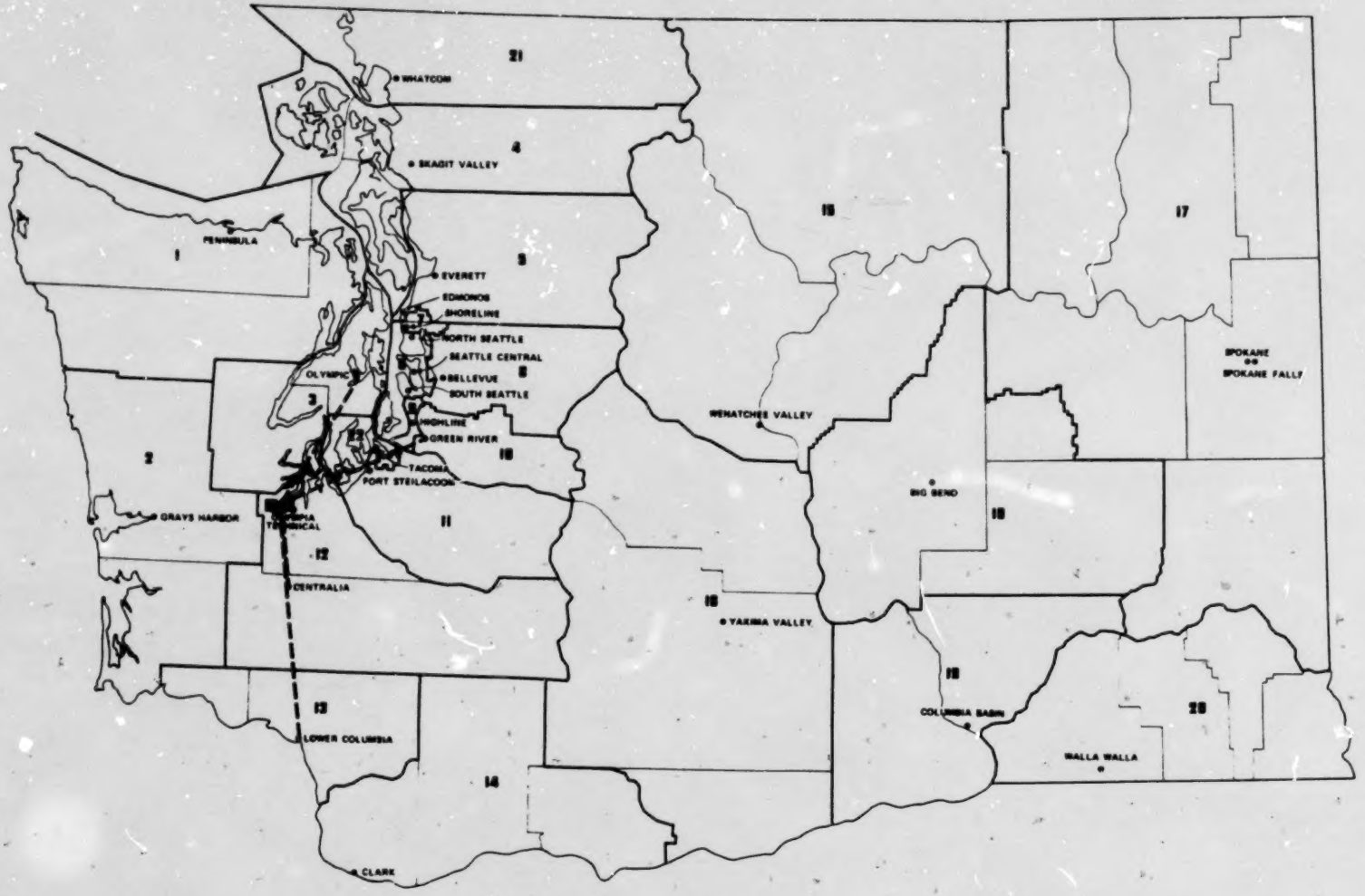
# The Washington Community College System



COMMUNITY COLLEGE INSTRUCTIONAL COMPUTING

Lo-Speed Terminals to The Evergreen State College

# The Washington Community College System



# INDIVIDUAL
# COLLEGE PROFILES

# PENINSULA

*INSTRUCTIONAL COMPUTING CONTACT: TED GRAVES*

## COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| MATH 114 Intro to Programming | 3 | Lo-Speed Terminal |
| MATH 115 Intro to Programming | 3 | Lo-Speed Terminal |
| ENGR 114 Comp Appl in Engr. Probs | 3 | Lo-Speed Terminal |
| Special Projects | 1-5 | Lo-Speed Terminal |

## COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| Forestry | | Mini-computer |

## PLANNED ACTIVITIES

*Shared use of administrative and library terminals for computer assisted instruction primarily in chemistry classes.*

## RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| Texas Instruments ASR 733 | Lo-Speed Terminal | Owned | $ 1,000 |
| Sharp 364 | On-Site | Owned | |

## RESOURCES, SERVICES

| Description | FY78 Budget |
|---|---|
| Lo-Speed Interactive From TWICS | $ 2,000 |

# GRAYS HARBOR

*INSTRUCTIONAL COMPUTING CONTACT: ED AKERSON*

## COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| DP 012 Keypunch | 2 | Data Entry |
| DP 100 Intro. to DP | 3 | RJE, Data Entry |
| DP 104 RPG Programming | 4 | RJE, Data Entry |
| DP 106 FORTRAN Porgramming | 3 | RJE, Data Entry |
| DP 211 COBOL Porgramming | 4 | RJE, Data Entry |
| DP 221 DP Lab | 4 | RJE, Data Entry |
| DP 291, 293 Special Projects | 1-5 | RJE, Data Entry |
| ENGR 154 FORTRAN Problem Solving | 4 | RJE, Data Entry |

*Grays Harbor has program approval for vocational data processing training. They have a one-year program which leads to a one-year Data Processing Certificate.*

## COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

*None*

## PLANNED ACTIVITIES

*Grays Harbor plans to start some classes in BASIC programming that will utilize lo-speed terminals.*

## RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| Remcom 4780 W/Command | RJE | Owned | $12,500 |
| IBM-026 Keypunch | Data Entry | Owned | |
| IBM-026 Keypunch | Data Engry | Leased | * |
| IBM-026 Keypunch | Data Entry | Leased | |
| IBM-029 Keypunch | Data Entry | Owned | |

*Included in figure on following page

## GRAYS HARBOR (CONTINUED)

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| IBM-029 Keypunch | Data Entry | Owned | |
| IBM-129 Data Recorder | Data Entry | Leased | $ 2,419 |
| IBM-056 Key Verifier | Data Entry | Owned | |
| Wang Calculator w/plotter | On site | Owned | |

RESOURCES, SERVICES

| Description | FY78 Budget |
|---|---|
| Hi-Speed RJE Computing Support from WSUCC | $ 1,900 |
| Line Cost | 2,400 |

# OLYMPIC

*INSTRUCTIONAL COMPUTING CONTACT: HARLAN TORMANEN*

## COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| DP 110 DP Concepts | 5 | Lo-speed Terminal |
| DP 160 Programming with BASIC | 3 | Lo-speed Terminal |
| DP 115 Comp. Architecture & OS | 1-7 | RJE |
| DP 170 Programming with RPG | 3 | RJE |
| DP 240 Programming with COBOL | 1-7 | RJE |
| DP 295 Special Problems | 1-5 | RJE |
| MATH 115/221 Intro to Digital Computer | 4 | RJE |
| DP 130 Programming with Assembler | 1-7 | RJE |
| DP 230 Programming with Assembler | 1-7 | RJE |
| DP 280 Adv. Programming Techniques | 3 | RJE |
| DP 215 OS and JCL | 1-7 | RJE |
| DP 100 Keypunch Machine Operation | 8 | Data Entry |

*Olympic has program approval for vocational Data Processing training.*

## COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| ECON 201 Economic Principles and Problems | 5 | RJE |

## PLANNED ACTIVITIES

*Olympic plans to acquire a PRIME Mini-computer to support both their interactive BASIC requirements and higher-level language batch processing. The PRIME will also be used in the data entry program to provide access to an on-line data entry environment.*

# OLYMPIC (CONTINUED)

RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| UNIVAC 9200 & Modems | RJE | Owned | $ 6396 |
| 2 201B Modems | | Leased | 1200 |
| 2 Decwriter Terminals | Lo-speed Terminal | Owned | 1032 |
| 5 IBM 029 Keypunches | Data Entry | Leased | 5256 |
| 1 IBM 129 Keypunch | Data Entry | Leased | 2004 |
| 2 UNIVAC 1710 Keypunches | Data Entry | Leased | 4368 |
| 1 IBM 026 Keypunch | Data Entry | Owned | - 0 - |
| 1 IBM 056 Verifier | Data Entry | Owned | - 0 - |
| HP 2010 W/Plotter | On-site | Owned | - 0 - |

RESOURCES, SERVICES

| Description | FY78 Budget |
|---|---|
| Computing Support from WSU | $ 7166 |
| Computing Support from TESC | 1100 |
| Line and Port Costs to WSU | 4392 |
| Line Costs to TESC | 972 |

# SKAGIT VALLEY

*INSTRUCTIONAL COMPUTING CONTACT: BOB BATTERBERRY*

COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| CS 130 Computer Programming Basic | 5 | On-site, Lo-speed |
| CS 210 Computer Fundamentals | 3 | On-site, Lo-speed |
| CS 231 Computer Applications | 3 | On-site, Lo-speed |
| CS 253,4,5 Independent Study | 3-5 | On-site, Lo-speed |
| ET 139 Computer Fundamentals | 3 | On-site, Lo-speed |
| ET 281 Digital Systems I | 6 | On-site, Lo-speed |
| ET 283 Digital Systems II | 6 | On-site, Lo-speed |
| ET 285 Digital Systems III | 6 | On-site, Lo-Speed |
| CS 220 Assembly Language Programming | 3 | On-site, Lo-Speed |

COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| *None* | | |

RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| Univac 1218 | On-site | Owned | |
| PDP II VO3 | On-site | Owned | |
| PDP II VO3 | On-site | Owned | |
| 3-Digital Terminals | Lo-Speed | Owned | $ 6,000 |
| Microprocessor Trainers | On-site | Owned | |
| CDC 160A | On-site | Owned | |
| 2 TTY 33 | Lo-Speed | Owned | |

RESOURCES, SERVICES

| Description | FY78 Budget |
|---|---|
| Tymshare, Inc., TESC | $ 100 |

# EVERETT

*INSTRUCTIONAL COMPUTING CONTACT: GORDON KIMBLE*

COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| DAPR 100 Intro to DP | 3 | Lo-Speed Terminals |
| DAPR 101 Intro to Punched Card Equipment | 3 | Data Entry, Unit Record |
| DAPR 105 Intro to Digital Comp | 4 | Lo-Speed Terminals |
| DAPR 106 FORTRAN Programming | 4 | Lo-Speed Terminals |
| DAPR 107 RPG Programming | 5 | Off campus |
| DAPR 109 Advanced RPG Programming | 5 | Off campus |
| DAPR 201 Intro to Sys/360 | 3 | Lo-Speed Terminals |
| DAPR 205 COBOL Programming | 5 | Lo-Speed Terminals |
| DAPR 206 COBOL Programming | 5 | Lo-Speed Terminals |
| DAPR 210 Systems Design | 5 | Lo-Speed Terminals |
| DAPR 211 Systems Project | 5 | Lo-Speed Terminals |
| DAPR 215 Seminar-Internship | 2-5 | Lo-Speed Terminals |
| DAPR 220 Computer Language Lab | 3 | Lo-Speed Terminals |
| DAPR 221 Computer Language Lab | 3 | Lo-Speed Terminals |
| DAPR 299 Special Projects | 2-5 | Lo-Speed Terminals |
| ENGR 171 Elm Comp Prog | 4 | Lo-Speed Terminals |
| DAPR 108 Bus DP Applications | 3 | Lo-Speed Terminals |
| DAPR 202 Sys/360 Assembler | 4 | Lo-Speed Terminals |
| MATH 171 Elem Comp Prog. | 4 | Lo-Speed Terminals |

*Everett has program approval for vocational DP training.*

COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| *None* | | |

# EVERETT (CONTINUED)

## RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| ADDS CRT Terminal | Lo-Speed Terminal | Owned | |
| 2 Hazeltine 1200's | Lo-Speed Terminal | Owned | |
| TI 735 | Lo-Speed Terminal | Owned | $ 300 |
| TI 745 | Lo-Speed Terminal | | |
| 3 IBM 024 Keypunch | Data Entry | Owned | |
| 3 Dec Writer II's | Lo-Speed Terminal | Owned | $ 612 |

## RESOURCES, SERVICES

| Description | FY78 Budget |
|---|---|
| Lo-Speed Interactive from ESD 189 | $12,000 |
| City of Lynnwood Off-Campus Usage | 1,000 |

# EDMONDS

*INSTRUCTIONAL COMPUTING CONTACT: GARY ISHAM*

## COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| DP 100 Intro to Automated DP | 3 | On-site |
| Math 115 Computer Programming | 4 | On-site |
| Math 215 FORTRAN Programming | 5 | On-site |
| ELTRN 164,165,166,167,168 - Electronics Update Computer Programming | 1 Each | On-site |
| ELTRN 264 Intro to Comp & Micro | 1 | On-site |
| ELTRN 265 Survey of Microprocessing | 1 | On-site |
| ELTRN 266 8080/8085 Microprocessor | 2 | On-site |
| ELTRN 267 Appl & Adv Progr. of 8080 Micr | 2 | On-site |

## COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| Math 151, 152, 153 Calculus | 5 Each | On-site |
| Math 120 Survey of Math | 5 | On-site |
| Math 140 Finite Mathematics | 5 | On-site |
| Math 240 Statistics | 5 | On-site |
| Physics 101 General Physics | 5 | On-site |
| Physics 102 General Physics | 5 | On-site |
| Physics 103 General Physics | 5 | On-site |
| Physics 140 General Physics | 5 | On-site |
| Physics 201 Engineering Physics | 5 | On-site |
| Physics 202 Engineering Physics | 5 | On-site |
| Physics 203 Engineering Physics | 5 | On-site |
| Off-Ad Keypunch | 5 | On-site |
| Off-Ad Word Processing | 5 | On-site |

## EDMONDS (CONTINUED)

### PLANNED ACTIVITIES

*Edmonds plans to add the following: Computer and Society; CAI, vocational supplementary; graphics; transfer computer science; chemistry simulations; economics simulations.*

### RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| Digilog | On-site | Owned | |
| Prime 300 System | On-site | Owned | |
| 4 INFOTON Vistar CRT's | Lo-Speed Terminal | Owned | $ 2,400 |
| TTY ASR 33 | Lo-Speed Terminal | Owned | |
| LA 36 DecWriter | Lo-Speed Terminal | Owned | |
| 8080 Intel Microprocessor | On-site | Owned | |

### RESOURCES, SERVICES

| Description | FY78 Budget |
|---|---|
| Lo-Speed Interactive from WSUCC, TESC, TWICS, UW | $ 1,000 |

# SEATTLE CENTRAL

*INSTRUCTIONAL COMPUTING CONTACT: DIANA STARK*

COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| 5102 DAT 032 Keypunch I | 3 | Data Entry |
| 5102 DAT 033 Keypunch II | 3 | Data Entry |
| 5102 DAT 036 Theory of KP Operation and Application | 7 | Data Entry |
| 5101 DAT 100 Survey of Data Processing | 3 | On-site |
| 5101 DAT 101 Computer Input Tech. | 1 | Data Entry, Lo-Speed Terminal, On-site |
| 5101 DAT 105 Comp. Logic & Prog. Tech. | 4 | On-site |
| 5101 DAT 106 Comp. Fund./BASICS | 4 | On-site |
| 5101 DAT 117 Comp. Prog./RPGII | 4 | On-site |
| 5101 DAT 131 Comp. Prog./ALC I | 4 | RJE |
| 5101 DAT 132 Comp. Prog./Beg. COBOL | 4 | On-site |
| 5101 DAT 133 Comp. Prog./JCL I | 4 | RJE |
| 5101 DAT 145 Comp. Operations I | 4 | On-site |
| 5101 DAT 149 Comp. Operations II | 4 | On-site, Off-Campus, RJE |
| 5101 DAT 150 Comp. Operations Lab. | 1 | On-site, Off-Campus, RJE |
| 5101 DAT 197-199 Work Experience in DP | 1-8 | Off-campus |
| 5101 DAT 205 Comp. Prog./BASIC | 2 | On-site |
| 5101 DAT 231 Comp. Prog./ALC II | 4 | RJE |
| 5101 DAT 232 Comp. Prog./Adv. COBOL | 4 | RJE |
| 5101 DAT 233 Comp. Prog./FORTRAN | 4 | On-site, RJE |
| 5101 DAT 234 Teleprocessing Access Methods | 4 | On-site, RJE |
| 5101 DAT 235 Comp. Prog./PLI | 4 | RJE |
| 5101 DAT 236 Data Base Mangement | 4 | |
| 5101 DAT 255 Systems Design I | 4 | All |
| 5101 DAT 256 Systems Design II | 4 | All |
| 5101 DAT 264 Comp. Prog. Lab. | 1 | All |
| 5101 DAT 290 Internship/Ind. Study | 1-6 | All |

## SEATTLE CENTRAL (CONTINUED)

*Seattle Central has program approval for vocational Data Processing training. Data processing degrees/certificates awarded:*

*(1) Two-year degree - data processing technology*
*(2) Three-quarter certificate - computer operations*
*(3) One-quarter certificate - data entry operations*

**COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION**

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| BUS 174 Applied Bus. Stat | 5 | RJE |
| BUS 210 Bus. & Economic Stat. | 5 | RJE |
| ACC 103 Accounting Princ. III | 5 | RJE |
| AIB Program BAN 100 Fund. of Data Processing | 3 | Off-campus |
| Chemistry CHE 090 Beginning Chemistry | 5 | Lo-Speed Terminal |
| CHE 192 General Chemistry | 8 | Lo-Speed Terminal |
| CHE 211 Chemistry for Tech. | 7 | Lo-Speed Terminal |
| CHE 212 Chemistry for Tech. | 7 | Lo-Speed Terminal |
| CHE 244 Radiation Measurements | 2 | Lo-Speed Terminal |
| CHE 282 Organic Chemistry | 5 | Lo-Speed Terminal |
| CHE 299 Special Problems | 1-5 | Lo-Speed Terminal |
| Physics PHY 299 Special Problems | 1-5 | Lo-Speed Terminal |

**PLANNED ACTIVITIES**

*Plans are to integrate use of the computer into the Business Machines (BUS 107) and Word Processing (SEC 202) within the next year.*

*Additionally, Seattle Central has applied for a major grant which, if approved, will result in an upgrade of the existing Prime 300 System to accommodate the "computerization" of many of the basic skills areas. Namely, those basic skills areas include: (1) The Math Labs (MAT 090), (2) The Reading Labs, (CEP 080), (3) The Writing Labs (CEP 085).*

# SEATTLE CENTRAL (CONTINUED)

## RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| Prime 300 System 128KB | On-site,RJE | Owned | |
| Pertec Disk (12M BYES) | | Owned | $ 9,071 |
| 300 LPM Printer | | Owned | |
| 600 CPM Card Reader | | Owned | |
| FE Terminet Console | | Owned | |
| 2 GTX CRT Terminals | Lo-Speed Term. | Owned | |
| 2 Infoton 200/2 CRT's | Lo-Speed Term. | Owned | |
| 1 LA36 Decwriter II | Lo-Speed Term. | Owned | |
| 3 38 PSR TTY's | Lo-Speed Term. | Owned | |
| 1 407 Accounting Machine | Unit Record | Owned | |
| 7 029 Keypunches | Data Entry | Owned | |
| 2 026 Keypunches | Data Entry | Owned | |
| 1 IBM 056 Verifier | Data Entry | Owned | |
| 2 026 Keypunches | Data Entry | Owned | |
| 1 IBM 056 Verifier | Data Entry | Owned | |
| 1 IBM 059 Key Verifier | Data Entry | Owned | |
| 1 IBM 129 Data Recorder | Data Entry | Owned | |
| 1 Singer Key-to-Tape | Data Entry | Owned | |
| 1 Portacom Terminal | Lo-Speed Term. | Owned | |
| 1 Hazeltine 1500 CRT | Lo-Speed Term. | Owned | |
| 1 077 Collator | Unit Record | Leased | |
| 1 552 Interpreter | Unit Record | Leased | |
| 5 519 Reproducer | Unit Record | Leased | $ 11,995 |
| 5 024 Keypunches | Data Entry | Leased | |
| 2 026 Keypunch | Data Entry | Leased | |
| 1 IBM Verifier | Data Entry | Leased | |

## RESOURCES, SERVICES

| Description | FY78 Budget |
|---|---|
| Computing Support from WSUCC | $ 5,000 |

# NORTH SEATTLE

*INSTRUCTIONAL COMPUTING CONTACT: GEORGE MILLER*

COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| 5101 DAT 100 Survey of D.P. | 3 | On-site |
| 5101 DAT 102 Intro to Comp. Prog. | 5 | On-site |
| 5101 DAT 114 File Manipulation | 4 | On-site |
| 5101 DAT 117 Comp. Prog/RPG II | 4 | On-site |
| 5101 DAT 131 Comp. Prog/Beg. BAL. | 4 | RJE |
| 5101 DAT 132 Comp. Prog/ Beg. COBOL | 4 | On-site RJE |
| 5101 DAT 134 Comp. Operating Systems | 5 | On-site RJE |
| 5101 DAT 137 Intro. to Teleprocess. | 3 | On-site |
| 5101 DAT 139 Prime Assembler Lang. | 5 | On-site |
| 5101 DAT 158 Computer I/O Control | 2 | On-site |
| 5101 DAT 205 Comp. Prog/BASIC | 2 | On-site |
| 5101 DAT 231 Comp. Prob/Adv. BAL | 4 | RJE |
| 5101 DAT 232 Comp.Prod/Adv. COBOL | 4 | RJE |
| 5101 DAT 233 Comp.Prog/FORTRAN | 4 | On-site |
| 5101 DAT 235 Comp. Prog. PL/I | 4 | RJE |
| 5101 DAT 236 Data Base Management | 4 | |
| 5101 DAT 255 Systems Analysis I | 4 | All |
| 5101 DAT 256 Systems Analysis II | 4 | All |
| 5101 DAT 258 Mini-Computer Ops. | 2 | On-site |
| 5101 DAT 290 Internship/Ind.Study | 1-8 | All |

*North Seattle has program approval for vocational DP training. The DP degrees/certificates awarded are: (1) Two year degree - DATA PROCESSING TECHNOLOGY*
*(2) 3 quarter - COMPUTER PROGRAMMING CERTIFICATE.*

# NORTH SEATTLE (CONTINUED)

## COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| EET 121 Prog. Fund. for Electronics Students | 5 | On-site |
| EET 203 Digital Logic & Comp. Fund | 15 | On-site |
| EET 205 Digital Applications and Mini-Computers | 15 | On-site |

## PLANNED ACTIVITIES

*Plans for the future are to extend the use of the computer into the Secretarial Science Word Processing area.*

## RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| Prime 300 System: (192KB) | On-site RJE | Owned | |
| 80 MB Disk Storage | On-site RJE | Owned | |
| 200 LPM Printer | On-site RJE | Owned | |
| 10 Electronics Dept. Intel. 8080 Micro-Computers | On-site | Owned | |
| DEC CRT Display VT50 | Lo-Speed Terminal | Owned | |
| IBM 026 Keypunch | Data Entry | Owned | |
| 3 DEC LA30 Printers | Lo-Speed Terminal | Owned | |
| Electronics Dept. REHEX Papertape Punch | Lo-Speed Terminal | Owned | |
| Electronics Dept. Add-master Paper Tape Reader | Lo-Speed Terminal | Owned | |
| 2 TI 733 ASR Printer Terminals | Lo-Speed Terminal | Owned | |
| 5 Hazeltine 2000 CRT Terminals | Lo-Speed Terminal | Owned | |
| TI 733 KSR Printer Terminal | Lo-Speed Terminal | Owned | |
| 2 Hazeltine Tape Cassettes | Lo-Speed Terminal | Owned | |

# NORTH SEATTLE (CONTINUED)

RESOURCES, EQUIPMENT (Continued)

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| 2 ASR 33 Teletypes | Lo-Speed Terminal | Owned | |
| 2 VISTAR GTX Terminals | Lo-Speed Terminal | Owned | |
| PDP/8/E (Electronics Dept.) | On-site | Owned | |
| PDP/8/F (Electronics Dept.) | On-site | Owned | |
| | | TOTAL | $8,500 |

# SOUTH SEATTLE

*INSTRUCTIONAL COMPUTING CONTACT: REUBEN KROGSTAD*

## COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| DAT 100 Intro to DP | 3 | |

## COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| OTE 262 Instructional Use of the Computer | 3 | |

## PLANNED ACTIVITIES

*South Seattle plans to incorporate use of the computer, either via terminals or on-site mini, into the Engineering Technology Program during the 1978-79 academic year.*

## RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| *None* | | | |

# SHORELINE

*INSTRUCTIONAL COMPUTING CONTACT: HOWARD HUBBARD*

COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| ELEC 230 Assembler Prog. | 5 | On-site |
| MATH 200 Basic Prog. | 2 | Lo-Speed Terminal |
| ENGR 115 FORTRAN Prog. | 3 | Lo-Speed Terminal |
| MATH 202 Computer Lab | 5-3 | On-site |
| MATH 116 Survey of Computers | 2 | On-site |

COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| MATH 281 Statistics, DP | 5 | On-site |
| ENGR 155 Surveying, DP | 5 | On-site |
| MATH 238 Diff. Equations Graphics | 3 | On-site |
| CHEM 191/192 Elec, Opt, Chem, Methods | 6/6 | On-site |
| BUS AD 240 Survey of Data Processing | 3 | On-site |
| CHEM 150 Experiment Simulation | 4 | On-site |
| BGS 101 Survey of Bus. Gov. & Society Sim. | 5 | On-site |
| CHEM 150H Experiment Simulation | 4 | On-site |
| Dental Hygn. 260/261 Student Eval. System | 6/2 | On-site |
| PSYCH 100H Psychology DP | 5 | On-site |
| MATH 181 Statistics DP | 4 | On-site |
| GEOG. 207 Economic Geog. DP | 5 | On-site |
| MATH 124,5,6 Calculus, DP & Simulator and Graphics | 5 | On-site |
| MATH 205 Linear Algebra, Graphics | 3 | On-site |
| Ocean T. L97 Oceanography (data process) | 6 | On-site |
| BUS AD 254 Small Bus. Management (Simulation) | 5 | On-site |
| English 102 English forms, DP | 5 | On-site |
| MATH 40 Elem. Algebra (CBI Program) | 5 | On-site |
| MATH 105 Functions, Graphics | 5 | On-site |
| MATH 110 Topics in Math Demos | 5 | On-site |
| MATH 191/192/193 Tech Math DP, Graphics | 5/5 | On-site |

# SHORELINE (CONTINUED)

## PLANNED ACTIVITIES

*Shoreline plans to add computer utilization in the following courses: Personal Finance; Business Math; Accounting; Economics; MRT Document File. Also, the psychology department is acquiring 3 microcomputers to use as data-gathering devices in field experiments.*

## RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| Prime 300 System | On-site | Owned | |
| 9 GTX CRT Terminals | Lo-Speed Terminal | Owned | |
| 2 Teletypes | Lo-Speed Terminal | Owned | $ 100 |
| Tektronix 4662 Plotter | On-site | Owned | |
| DecWriter II | Lo-Speed Terminal | Owned | 600 |

# BELLEVUE

*INSTRUCTIONAL COMPUTING CONTACT: LYNN TOOLEY*

## COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| BA 210 Intro to Comp. Prog. (BASIC) | 3 | Lo-Speed Terminals |
| MATH 114 Intro to Comp Prog. (BASIC) | 3 | On-site |
| BA 220 Intro to FORTRAN Programming | 3 | Lo-Speed Terminals |

## COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| QM 110 EDP Orientation | 3 | Lo-Speed Terminals |
| MATH 205 Linear Algebra | 5 | On-site |
| MATH 124 Calculus | 5 | On-site |
| MATH 238 Diff. Equations | 3 | On-site |

## PLANNED ACTIVITIES

*Bellevue plans to add computing utilization in the following courses: Chemistry Simulations; Physics; Accounting and Marketing Simulation. Computer-generated testing for mathematics and chemistry is being implemented.*

## RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| Wang Calculator | On-site | Owned | |
| 4 Hazeltine 2000, Tape Units | Lo-Speed Terminal | Owned | $ 2,400 |

## RESOURCES, SERVICES

| Description | FY78 Budget |
|---|---|
| Time-share service from Seattle Pacific | $ 6,100 |

# HIGHLINE

*INSTRUCTIONAL COMPUTING CONTACT: ART MASSEY*

COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| DP 101 Computer Concepts | 7 | On-site |
| DP 102 Programming Fundamentals | 7 | On-site |
| DP 105 Automatic D.P. | 3 | On-site |
| DP 107 RPG Programming | 3 | On-site |
| DP 110 Digital Computing, Using FORTRAN | 3 | On-site |
| DP 115 Programming Using COBOL | 7 | On-site |
| DP 121 COBOL Programming | 3 | On-site |
| DP 122 COBOL Programming | 3 | On-site |
| DP 130 Assembler Programming | 3 | On-site |
| DP 180 Computer Operations | 2 | On-site |
| DP 210 Adv. Prog. Techniques | 7 | On-site |
| DP 220 Adv. Prog. Applications | 7 | On-site |
| DP 230 Systems & Procedures | 7 | On-site |
| DP 240 Coop. Work Exp. | 2 | Off-campus |
| DP 291-5 Ind. Study | 1-5 | On-site |
| Trans 220 PARS-Computer Reservations | 3 | Lo-Speed terminal |
| Trans 221 Passenger Service | 3 | Lo-Speed terminal |
| DP 100 Computers & Society | 5 | On-site |
| DP 195 Programming Laboratory | 3 | On-site |

COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| None | | |

PLANNED ACTIVITIES

*In Instructional Computing, Highline is exploring the following actions and activities:*

*(1) Sell 360/40, return leased peripherals.*

## HIGHLINE (CONTINUED)

**PLANNED ACTIVITIES** (Continued)

*(2) Acquire an RJE Terminal for Data Processing Technology Program to WSU - batch processing support via REMCOM 4780.*

*(3) Acquire either a PRIME mini-computer for on-campus interactive computing, or expand utilization of other state time-sharing hosts such as EWU, with intent to acquire mini-computer at a later date.*

*(4) Expand curriculum offerings to provide contemporary, interactive and batch-based course offerings.*

**RESOURCES, EQUIPMENT**

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| 7 IBM 029 Keypunches | Data Entry | Owned | |
| 1 IBM 026 Keypunch | Data Entry | Owned | |
| IBM 059 Verifier | Data Entry | Owned | |
| IBM 360/40 DOS Disk/Tape System | On-site | Owned | $ 37,875* |
| 548 Interpreter | Unit Record | Owned | |
| 085 Collator | Unit Record | Owned | |
| 083 Sorter | Unit Record | Owned | |
| 519 Reproducer | Unit Record | Owned | |
| 6 INCOTERM CRT Units | Lo-Speed | Leased | 6,000 |
| 2 Decwriter II Terminals | Lo-Speed | Owned | 71 |
| 1 CRT w/Floppy disk | Lo-Speed | Owned | |

**RESOURCES, SERVICES**

| Description | FY78 Budget |
|---|---|
| Line Costs to TWICS | $ 950 |
| Lo-Speed Interactive from TWICS | 5,000 |

*Includes some administrative work

# GREEN RIVER

*INSTRUCTIONAL COMPUTING CONTACT: BOB CHRISTIANSON*

## COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| DP 100 INTRO to DP | 3 | Lo-Speed Terminals |
| DP 102 BASIC PROG | 2 | Lo-Speed Terminals |
| DP 115 FORTRAN IV | 4 | Lo-Speed Terminals |
| DP 299 Special Problems | 1-5 | Lo-Speed Terminals |
| GE 115 FORTRAN IV-ENGR. | 4 | Lo-Speed Terminals |

## COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| *None* | | |

## RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| 5 TTY Terminals | Lo-Speed | Owned | |

## RESOURCES, SERVICES

$ 5,200

Description

Computing Services, TESC
Computing Services, WSU

# FORT STEILACOOM

*INSTRUCTIONAL COMPUTING CONTACT: JIM RICHARDSON*

## COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| CSCI 223 FORTRAN | 5 | RJE |
| CSCI 201 Intro to Comp. Science | 3 | RJE |
| DP 101 Computer in Bus. & Society | 3 | |
| DP 120 Timesharing Basic | 3 | Lo-Speed Terminal |
| DP 121 Intro to Data Processing | 5 | |
| DP 123 Systems and Procedures | 5 | RJE |
| DP 124 RPG Programming | 5 | RJE |
| DP 125 Assembler Programming | 5 | RJE |
| DP 210 Data Communications | 3 | |
| DP 221 COBOL Programming | 5 | RJE |
| DP 222 Advanced Assembler Prog. | 5 | RJE |
| DP 223 FORTRAN IV Prog. | 5 | RJE |
| DP 225 Adv. COBOL Prog. | 5 | RJE |
| DP 226 Supervised Internship | 5 | |
| DP 227 Advanced Topics | 5 | |
| DP 228 Advanced Topics | 5 | |

*Fort Steilacoom has program approval for vocational Data Processing training. They offer Two, two-year degrees: (a) An Associate of Arts and Sciences (A.A.S.) in Data Processing; and (b) An Associate of Technology (A.T.) in Data Processing.*

## COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

*None*

## PLANNED ACTIVITIES

*Plans are to start DP 110 Fall Quarter 1978: DP for Management - 5 credits.*

# FORT STEILACOOM (CONTINUED)

RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| REMCOM 4780 | RJE | Owned | $ 3,000 |
| 2 TI 735 ASR Terminals | Lo-Speed | Owned | |
| 1 IBM 029 Keypunch | Data Entry | Owned | |
| 3 IBM 029 Keypunches | Data Entry | Leased | 3,240 |

RESOURCES, SERVICES

| Description | FY78 Budget |
|---|---|
| Hi-Speed RJE Computing Support from WSUCC | $ 6,000 |

# CENTRALIA

*INSTRUCTIONAL COMPUTING CONTACT: ALICE FORTH*

COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| BA 103 Survey of Data Proc. | 2 | Lo-Speed |
| BA 130 Flowcharting & Comp. Logic | 2 | Lo-Speed |
| BA 217 Basic Computer Programming | 3 | Lo-Speed |
| BA 218 Intro to Comp. Programming | 3 | Lo-Speed |
| MATH 141 Interactive Computing & Programming | 2 | Lo-Speed |
| MATH 230 Digital Computer Programming | 3 | Lo-Speed |
| DEKP 120 Data Entry/Keypunch | 15 | Data Entry |

COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| *None* | | |

RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| TTY ASR 33 Teletype | Lo-Speed | Owned | $ 390 |
| Hazeltine 1000 Terminal | Lo-Speed | Owned | |
| IBM 129 Data Recorder | Data Entry | Leased | $ 33,016 |
| 5 IBM 029 Keypunches | Data Entry | Leased | |
| 2 IBM 3742 Keydisks | Data Entry | Leased | |
| IBM 3741 Keydisk | Data Entry | Leased | |
| Univac 1701 VIP | Data Entry | Leased | |
| Univac 1601 Keypunch | Data Entry | Leased | |
| 360/30 System Located at OTCC | On-site,RJE | | |

RESOURCES, SERVICES

| Description | FY78 Budget |
|---|---|
| Computing Services, TESC | $ 1,870 |

# OLYMPIA TECHNICAL

*INSTRUCTIONAL COMPUTING CONTACT: FRANKIE SCHLENDER*

## COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| DP 141 Intro and RPG Prog. | 7 | RJE |
| DP 142 Computer Operation | 1 | On-site |
| DP 151 COBOL Prog. | 7 | RJE |
| Math 235 Finite Math | 3 | On-site |
| DP 161 Adv. COBOL Prog. | 7 | RJE |
| DP 162 Intro to OS/JCL | 4 | RJE |
| DP 163 Systems Analysis | 5 | On-site |
| DP 241 Assembler Prog. | 7 | On-site |
| DP 242 Adv. OS/JCL | 3 | RJE |
| Bus. 181 Bus. Princ. & Management | 5 | RJE |

*Olympia Technical has program approval for vocational Data Processing training. They have a (1) two-year program which leads to a Data Processing Associate in Technical Arts Degree, (2) A one-year program which leads to a Computer Operation Certificate, (3) A one-quarter program to earn a Data Entry Certificate of Proficiency.*

## COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| *None* | | |

## PLANNED ACTIVITIES

*Olympia Technical plans to start a Computer Operator Course in Fall, 1978.*

# OLYMPIA TECHNICAL (CONTINUED)

RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| IBM 360/30 | On-site,RJE | Owned | |
| 3 Dec Writer II Terminals | Lo-Speed | Owned | |
| Hazeltine 1000 Terminal | Lo-Speed | Owned | |
| TTY33 Teletype | Lo-Speed | Owned | |
| 8 IBM 029 Keypunches | Data Entry | Leased | |
| 2 IBM 129 Data Recorders | Data Entry | Leased | |
| 2 IBM 3742 Data Stations | Data Entry | Leased | |
| IBM 3741 Data Station | Data Entry | Leased | |
| 2 Univac 1701 Keypunches | Data Entry | Leased | |
| Univac 1601 Keypunch | Data Entry | Leased | $ 82,328 |

RESOURCES, SERVICES

| Description | FY78 Budget |
|---|---|
| Hi-Speed RJE Computing Support from WSUCC | |
| Lo-Speed Terminal Support from WSUCC | |
| Lo-Speed Terminal Support from TESC | |

# GARRETT HEYNS

*INSTRUCTIONAL COMPUTING CONTACT: FRED MUELLER*

COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| DP 101 Intro to D.P. | 3 | Lo-Speed |
| DP 102 Prob. Definition | 3 | Lo-Speed |
| DP 103 Programming, BASIC | 3 | Lo-Speed |

COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| *None* | | |

RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| Some donated resources used for access to TESC | Lo-Speed | | |

# LOWER COLUMBIA

*INSTRUCTIONAL COMPUTING CONTACT: ALAN HOWARD*

COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| 5101 DATA 100 Intro to Data Processing | 3 | RJE, Lo-Speed Terminal Data Entry, Unit Record |
| 5102 DATA 160 Data Entry/ Keypunch Trng. | 10 | Lo-Speed Terminal, Data Entry and Unit Record |
| 5101 DATA 171 Survey of EDP | 5 | RJE, Data Entry, Unit Record, Lo-Speed Terminal |
| 5101 DATA 172 Computer Prog. Systems | 5 | RJE |
| 5101 DATA 173 RPG Programming | 5 | RJE, Off Campus |
| 5101 DATA 181 BASIC Programming | 5 | Lo-Speed Terminal |
| 5101 DATA 182 FORTRAN IV Programming | 5 | RJE |
| 5101 DATA 183 OS/JCL and Utility Prog. | 5 | RJE |
| 5101 DATA 274 COBOL I Programming | 5 | RJE |
| 5101 DATA 275 COBOL II Programming | 5 | RJE |
| 5101 DATA 284 Data Management | 5 | RJE |
| 5101 DATA 285 PL/I Programming | 5 | RJE |
| 5101 DATA 286 Systems Analysis & Design | 5 | RJE |
| 5101 DATA 288 Coop Work Experience | 3-5 | Off-campus |
| 5101 DATA 299 Independent Study | 1-5 | RJE, Off-campus |
| 5101 DATA 250 Seminar in DP/Micro-comp. | 5 | On-site |
| 5101 DATA 276 Assembly Language Programming | 5 | RJE |
| 0704 MATH 115 FORTRAN Programming | 5 | RJE |

COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| BSAD 206 Statistics | 5 | Lo-Speed Terminal |
| BSAD 100 Intro to Business | 5 | RJE |
| MATH 210 Statistics | 5 | Lo-Speed Terminal |

# LOWER COLUMBIA (CONTINUED)

COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION (Continued)

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| ENTRY 123 Surveying | 5 | Lo-Speed Terminal |
| ACCT. 233 Principles of Accounting | 5 | Lo-Speed Terminal |
| CHEM 111 General Chem. | 5 | Lo-Speed Terminal |
| CHEM 112 Organic | 5 | Lo-Speed Terminal |

PLANNED ACTIVITIES

*Lower Columbia plans to do the following: (1) Acquire a micro computer system to support a micro-computer course and a micro-graphics course. (2) Add two micro-computer classes to augment the existant DATA 250 Micro-computer Seminars. (3) Initiate computer graphics offerings useing the college-owned TEK 4006/4662 Graphics/Plotter terminals.*

RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| REMCOM 4780 System | RJE | Owned | $ 6,000 |
| Data Pump Utronics 2400 | RJE | Leased | |
| TI 733 ASR Terminal | Lo-Speed | Owned | 5,892 |
| 2 TI 733 KSR Terminals | Lo-Speed | Owned | |
| TI 735 KSR Terminals | Lo-Speed | | |
| TI 745 KSR Portable Terminal | Lo-Speed | Owned | |
| Hazeltine 2000 CRT | Lo-Speed | Owned | |
| Hazeltine 1500 CRT | Lo-Speed | Owned | |
| 2 Asciscope CRT's | Lo-Speed | Owned | |
| Tektronix 4006 Graphics CRT | Lo-Speed | Owned | |
| Tektronix 4662 Plotter | Lo-Speed | Owned | |
| 2 TTY ASR 33 Teletypes | Lo-Speed | Owned | |
| INFOTON CRT | Lo-Speed | Owned | |
| IMSAI 8080 Micro-computer | On-site | Owned | |
| Motorola 6800 Micro-computer Trainers | On-site | Owned | |
| 3 M SSO Testscoring Unit (Datronix) | Data Entry | Owned | |
| 2 IBM 026 Keypunches | Data Entry | Owned | |
| 4 IBM 029 Keypunches | Data Entry | Owned | |
| IBM 056 Verifier | Data Entry | Owned | |
| Univac 1710 VIP | Data Entry | Owned | |

# LOWER COLUMBIA (CONTINUED)

**RESOURCES, SERVICES**

| Description | FY78 Budget |
|---|---|
| Computing Support from WSUCC, TESC, TWICS | $ 13,000 |

# CLARK

*INSTRUCTIONAL COMPUTING CONTACT: JIM COWEN*

**COURSES DIRECTLY RELATED TO COMPUTING**

| Course | | Credits | Equipment Type Utilized |
|---|---|---|---|
| CSCI 101 | Intro to BASIC | 3 | On-site, variety |
| CSCI 102 | Intro to FORTRAN | 3 | On-site, variety |
| CSCI 103 | Intro to Assembly | 3 | On-site, variety |
| CSCI 201 | Intro to Computing | 3 | On-site, variety |
| CSCI 285 | Seminar | 2 | On-site, variety |
| DAPR 030 | Keypunch Operation | 1-6 | On-site, variety |
| DAPR 051 | Computer Operations | 3 | On-site, variety |
| DAPR 101 | Orientation to D.P. | 2 | On-site, variety |
| DAPR 105 | Intro to Electronic D.P. | 3 | On-site, variety |
| DAPR 106 | Intro to EDP (lab) | 2 | On-site, variety |
| DAPR 108 | Keypunch | 2 | On-site, variety |
| DAPR 120 | RPG Programming I | 5 | On-site, variety |
| DAPR 125 | Programming Lab I | 3 | On-site, variety |
| DAPR 130 | COBOL Prog. I | 5 | On-site, variety |
| DAPR 135 | Prog. Lab. II | 3 | On-site, variety |
| DAPR 141 | Work Exp. Seminar | 2 | On-site, variety |
| DAPR 143 | Work Exp. Seminar | 2 | On-site, variety |
| DAPR 145 | Work Exp. Seminar | 2 | On-site, variety |
| DAPR 199 | D.P. Work Experience | 2-3 | On-site, variety |
| DAPR 220 | RPG Programming II | 2 | On-site, variety |
| DAPR 230 | COBOL Prog. II | 3 | On-site, variety |
| DAPR 231 | Program Design | 3 | On-site, variety |
| DAPR 235 | COBOL Programming III (Lab) | 3 | On-site, variety |
| DAPR 240 | BASIC Assembly Prog. II | 2 | On-site, variety |
| DAPR 245 | Program Design Lab IV | 3 | On-site, variety |
| DAPR 250 | Systems Theory | 3 | On-site, variety |
| DAPR 255 | Projects Lab | 3 | On-site, variety |
| DAPR 260 | Programming Projects | 2 | On-site, variety |
| DAPR 275 | D.P. Seminar | 1-5 | On-site, variety |
| DAPR 280 | Advanced Programming | 1-3 | On-site, variety |
| DAPR 285 | Seminars | 2 | On-site, variety |
| DAPR 290 | Special Projects | 1-5 | On-site, variety |

## CLARK (CONTINUED)

### COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

*Students in Engineering, Philosophy, Physics, Chemistry, and Business all use the PRIME 300 for problem-solving applications.*

### PLANNED ACTIVITIES

*No new courses are planned except for seminars and mini-courses on Minis/Micros. The equipment is static at this point, but as the load increases on the PRIME, an upgrade to a 400 may be a possibility. Graphics packages may be offered to other schools that have campus terminals to utilize the Plot and Graphic capabilities of the PRIME.*

### RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| PRIME 300 System | On-site | Owned | |
| IBM 360/30 System* | On-site | Owned | |
| IBM 1620 System ** | On-site | Owned | |
| IMSAI 8080 Micro-computer | On-site | Owned | |
| TTY ASR 33 Teletype | Lo-Speed | Owned | |
| 6 Decwriter II LA36 Terminals | Lo-Speed | Owned | |
| 2 Portacom Terminals | Lo-Speed | Owned | |
| CDI Portable Printing Terminals | Lo-Speed | Owned | |
| 4 TTY KSR-33 Teletypes | Lo-Speed | Owned | |
| Hazeltine 2000 CRT | Lo-Speed | Owned | |
| Tektronix 4010 Graphics CRT | Lo-Speed | Owned | |
| 2 Model 350 ASCISCOPES | Lo-Speed | Owned | |
| IBM 085 Collator | Unit-Record | Owned | |
| IBM 548 Interpreter | Unit-Record | Owned | |
| IBM 083 Sorter | Unit-Record | Owned | |
| IBM 519 Reporducer | Unit-Record | Owned | |
| 11 IBM 024 Keypunches | Data Entry | Owned | |
| 2 IBM 026 Keypunches | Data Entry | Owned | |
| 2 IBM 029 Keypunches | Data Entry | Owned | |
| | | TOTAL | $ 26,100 |

* Also used for some administrative applications
** Not being used

# WENATCHEE VALLEY

*INSTRUCTIONAL COMPUTING CONTACT: RON BAKER*

COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| BUSA 120 Intro to Data Processing | 2 | None |
| MATH 159 Intro to Comp. Prog. | 3 | Lo-Speed terminal |
| MATH 160 Intro to FORTRAN | 3 | Lo-Speed terminal |
| MATH 161 COBOL Programming | 3 | Lo-Speed terminal |

COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| *None* | | |

PLANNED ACTIVITIES

*Wenatchee plans to expand their capability via the addition of more terminals.*

RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| TTY 38 Terminal | Lo-Speed | Leased | $ 840 |

RESOURCES, SERVICES

| Description | FY78 Budget |
|---|---|
| Computing support, WSU and Line Costs | $ 1,900 |

# YAKIMA VALLEY

*INSTRUCTIONAL COMPUTING CONTACT: DOUG NIELSON*

COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| DP 101 Intro to Data Processing | 3 | None |
| GE 115 Elem Prog. for Digital Comp. | 4 | RJE |
| MATH 103 Elem. Prog. for Digital Comp. | 3 | RJE |

COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| *None* | | |

RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| [illegible]S CP-413 Terminal* | RJE | Owned | |

RESOURCES, SERVICES

| Description | FY78 Budget |
|---|---|
| Computing Services, WSU | $ 300** |

* Not solely dedicated to instruction
** Estimated on a pro-rated basis

# SPOKANE

*INSTRUCTIONAL COMPUTING CONTACT: WALT WITTSTRUCK*

COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| COMP 201 Intro to Comp. Prog. | 5 | UNIVAC 9400 |
| DP 001 Keypunch | 6 | Data Entry |
| DP 002 Keypunch | 6 | Data Entry |
| DP 003 Keypunch | 6 | Data Entry |
| DP 004 Unit Record | 3 | Unit Record |
| DP 005 Seminar in Keypunch | 2-3 | Data Entry |
| DP 011 Intro to D.P. Principles | 4 | UNIVAC 9400 |
| DP 012 Computer Support Equipment | 4 | UNIVAC 9400 |
| DP 013 Principles of Comp. Prog. | 4 | UNIVAC 9400 |
| DP 014 Computer Hardware | 4 | UNIVAC 9400 |
| DP 015 Computer Software | 4 | UNIVAC 9400 |
| DP 016 Computer | 4 | UNIVAC 9400 |
| DP 021 Programming Systems | 4 | UNIVAC 9400 |
| DP 022 Computer Language | 4 | UNIVAC 9400 |
| DP 023 Programming Systems | 4 | UNIVAC 9400 |
| DP 024 Computer Languages | 4 | UNIVAC 9400 |
| DP 025 Bus. Systems Design & Dev. | 4 | UNIVAC 9400 |
| DP 026 Computer Languages | 4 | UNIVAC 9400 |
| DP 027 Field Applications | 4 | UNIVAC 9400 |
| DP 061 Coop. Wk - Keypunch | 3 | Data Entry |
| DP 062-63 Coop Wk - Keypunch | 3-3 | Data Entry |
| DP 066 Operations Research Tech. | 5 | UNIVAC 9400 |
| GBUS 240 Intro to D.P. | 3 | |

COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| MATH 106 Elem Num. Methods for D.P. | 5 | |

# SPOKANE (CONTINUED)

RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| UNIVAC 9400 Computer | On-site | Owned | |
| UNIVAC UTS-400 Terminal | Lo-Speed | Owned | |
| UNIVAC UTS-100 Terminal | Lo-Speed | Owned | |
| DEC PDP-8 System | On-site | Owned | |
| 6 IBM 129 Data Recorders | Data Entry | Owned | |
| 2 IBM 3741 Data Recorders | Data Entry | Owned | |
| 6 IBM 029 Keypunches | Data Entry | Owned | |
| 2 IBM 059 Verifiers | Data Entry | Owned | $ 43,160 |
| 2 IBM 056 Verifiers | Data Entry | Owned | |
| 2 IBM 026 Keypunches | Data Entry | Owned | |
| 4 IBM 024 Keypunches | Data Entry | Owned | |
| 1 UNIVAC 1701 VIP | Data Entry | Owned | |
| 1 SINKER 430[illegible] Key-to-Tape | Data Entry | Owned | |
| IBM 519 Reproducer | Unit Record | Owned | |
| IB[illegible] 083 Sorter | Unit Record | Owned | |
| IBM 548 Interpreter | Unit Record | Owned | |

# SPOKANE FALLS

*INSTRUCTIONAL COMPUTING CONTACT: NICK NICKOLOFF*

## COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| BUS 240 Intro to Data Processing | 3 | Lo-Speed Terminal |
| CS 210 FORTRAN | 5 | On-site, lo-speed terminal |
| CS 211 COBOL | 5 | On-site, lo-speed terminal |
| CS 291 Independent Study | 1-5 | On-site, lo-speed terminal |

## COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| CHEM 101,2,3 Gen. Chemistry | 5 Ea. | On-site, lo-speed |
| CHEM 100 Intro to Chemistry | 5 | On-site, lo-speed |
| CHEM 131 Organic Chemistry | 5 | On-site, lo-speed |
| CHEM 132 Biochemistry | 5 | On-site, lo-speed |
| CHEM 201,2,3 Organic Chemistry | 5 Ea. | On-site, lo-speed |
| ENG Statics & Dynamics | 5 | On-site, lo-speed |
| ENG Engineering Problems | 3 | On-site, lo-speed |
| ELEC Elec. Circuits | 5 | On-site, lo-speed |
| PHYSICS Eng. Physics | 5 | On-site, lo-speed |
| MATH 124,5,6 Calculus | 5 Ea. | On-site, lo-speed |
| BUS 201,2 Economics | 5 Ea. | On-site, lo-speed |

## PLANNED ACTIVITIES

*Spokane Falls plans to add testing services: test generating; test scoring; and item analysis. They will also be doing survey analysis for both students and faculty. In Graphics they are planning classroom demonstrations and graphic arts.*

# SPOKANE FALLS (CONTINUED)

RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| 1 Tektronix 4051 Graphic Terminal | On-site | Owned | |
| 1 Tektronix 4924 Tape Drive | On-site | Owned | |
| 1 Tektronix 4631 Hard Copy | On-site | Owned | |
| 2 LA 36DE Dec Writer Terminals | Lo-Speed | Owned | |
| 1 LA 180 Dec Printer | Lo-Speed | Owned | |
| 1 302A2-13 Acoustic Coupler (300) | Lo-Speed | Owned | |
| 1 3M Model 5500/F Data Entry System | Data Entry | Owned | |
| 1 Digilog Terminal with Acoustic Coupler | Lo-Speed | Owned | |
| 1 Hazeltine 1200 Terminal | Lo-Speed | Owned | |
| 1 Hazeltine Printer | | Owned | $ 12,000 |

RESOURCES, SERVICES

| Description |
|---|
| Computing Services, TWICS |
| Computing Services, WSU |

# BIG BEND

*INSTRUCTIONAL COMPUTING CONTACT: GEORGE CHAMPIE*

COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| CSC 111 Intro to D.P. | 5 | RJE, Lo-Speed Data Entry |
| CSC 115 Intro to Comp. Sci. | 4 | RJE, Lo-Speed, Data Entry |
| CSC 131 Programming Systems I, BAL | 5 | RJE, Lo-Speed, Data Entry |
| CSC 132 Programming Systems II, BAL | 5 | RJE, Lo-Speed, Data Entry |
| CSC 134 Mini Computers | 5 | RJE, Lo-Speed, Data Entry |
| CSC 199 Reading & Conference | 1-5 | RJE, Lo-Speed, Data Entry |
| CSC 201 Intro to Comp. Sci. | 5 | RJE, Lo-Speed, Data Entry |
| CSC 202 Comp. Science | 5 | RJE, Lo-Speed, Data Entry |
| CSC 231 RPG | 5 | RJE, Lo-Speed, Data Entry |
| CSC 232 Business Prog., COBOL | 5 | RJE, Lo-Speed, Data Entry |
| CSC 233 Systems Dev. & Design | 5 | RJE, Lo-Speed, Data Entry |
| CSC 299 Reading & Conference | 1-5 | RJE, Lo-Speed, Data Entry |
| SEC 110 Keypunch | 2 | Data Entry |
| CSC 133 Prog. Systems III, Assembler | 5 | Data Entry |

*Big Bend has program approval for vocational DP training.*

COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| BIOL 101 Biology (genetics) | 5 | On-site |
| AG Ag. Accounting & Mgt. | | On-site |

# BIG BEND (CONTINUED)

RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| Altair 680B w/scope | On-site | Owned | |
| REMCOM RJE | RJE | Leased | |
| Portacom Terminal | Lo-speed | Owned | |
| 4 IBM 029 Keypunches | Data Entry | Leased | $ 16,000 |

RESOURCES, SERVICES

| Description |
|---|
| Hi-Speed RJE Computing Support from WSUCC |

# COLUMBIA BASIN

*INSTRUCTIONAL COMPUTING CONTACT: JEWEL SMITH*

COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| BA 110 Intro to Bus. D.P. | 3 | On-site, Data Entry |
| CS 131 Intro to Comp. Science | 5+5(Lab) | On-site, Data Entry |
| CS 132 Assembler Language | 5+5(Lab) | On-site, Data Entry |
| CS 133 RPG | 5+5(Lab) | On-site, Data Entry |
| CS 199 Ind. Study | 1-5 | On-site, Data Entry |
| CS 261 FORTRAN IV | 5+5(Lab) | On-site, Data Entry |
| CS 262 COBOL | 5+5(Lab) | On-site, Data Entry |
| CS 263 Systems and Design | 5+5(Lab) | On-site, Data Entry |
| CS 299 Ind. Study | 1-5 | On-site, Data Entry |
| MTH 132 Intro to Comp. Science | 3 | On-site, Data Entry |
| MTH 133 Applied FORTRAN Prog. | 3 | On-site, Data Entry |

COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| *None* | | |

RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| Honeywell 2030 Computer System | On-site | Leased | $ 58,500* |
| 4 IBM 026 Keypunches | Data Entry | Owned | |
| IBM 056 Verifier | Data Entry | Owned | |
| IBM 548 Interpreter | Unit Record | Owned | |
| IBM 085 Collator | Unit Record | Owned | |
| IBM 083 Sorter | Unit Record | Owned | |
| IBM 519 Reproducer | Unit Record | Owned | |
| TI 733 KSR Terminal | Lo-speed | Owned | |

*Includes some administrative work

# WALLA WALLA

*INSTRUCTIONAL COMPUTING CONTACT: BOB DENNING*

**COURSES DIRECTLY RELATED TO COMPUTING**

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| BA 142 Keypunch | 3 | Data Entry |
| BA 143 Keypunch | 3 | Data Entry |
| BA 144 Keypunch | 3 | Data Entry |
| BA 164 Intro to D.P. | 5 | None |

**COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION**

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| *None* | | |

**RESOURCES, EQUIPMENT**

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| 2 IBM 129 Keypunches* | Data Entry | Leased | |

*Equipment in community businesses is also used on a volunteer basis.*

*administrative data processing equipment

# WHATCOM

*INSTRUCTIONAL COMPUTING CONTACT: NATE SMOTHERS*

**COURSES DIRECTLY RELATED TO COMPUTING**

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| BUS AD 138 Electronic DP | 3 | |

**COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION**

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| *None* | | |

**RESOURCES, EQUIPMENT**

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| None | | | |

**RESOURCES, SERVICES**

| Description | FY78 Budget |
|---|---|
| None | |

# TACOMA

*INSTRUCTIONAL COMPUTING CONTACT: ED ZIMMERMAN*

## COURSES DIRECTLY RELATED TO COMPUTING

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| ENGR 141 Comp. Applications for Engr. | 4 | Lo-speed |
| MATH 114 Elem. Comp. Programming | 5 | Lo-speed |
| PHYS 290 Comp. Appl. to Physics | 1-3 | Lo-speed |
| BA 118 Keypunch | 2 | Data Entry |
| BA 235 Intro to DP Survey | 5 | Lo-speed |

## COURSES THAT USE COMPUTING IN AN ANCILLARY FASHION

| Course | Credits | Equipment Type Utilized |
|---|---|---|
| SPAN 101,2,3 Spanish Vocab. Drill | | Lo-speed |
| MATH 104 Trig Plotting | | Lo-speed |

## PLANNED ACTIVITIES

*Tacoma plans to add the use of instructional computing in the following areas: Oceanography simulation; an MRT demo, Business Math Class and Police Officer Simulation.*

## RESOURCES, EQUIPMENT

| Description | Type | Ownership Status | FY78 Budget |
|---|---|---|---|
| 3 Decwriter II Terminals | Lo-speed | Owned | |
| 2 Lear-Siegler ADM 3A CRT Terminals | Lo-speed | Onwed | |
| 1 Perkin-Elmer Fox Terminal | Lo-speed | Owned | $ 450 |
| 1 Digilog Telecomputer II w/monitor | Lo-speed | Owned | |
| 2 Tektron Data Cassettes | | Owned | |
| 4 Keypunches | Data Entry | Owned | |
| 2 Keypunches | Data Entry | Leased | $ 2,316 |

# TACOMA (CONTINUED)

**RESOURCES, SERVICES**

| Description | FY78 Budget |
|---|---|
| Computing Services from WSU, TWICS | $ 7,500* |
| Communication Lines | 7,000 |

*Includes some WOIS changes

# PLANNING

# PROCEDURES

# INTRODUCTION

The "Planning Procedures" chapter of this document presents a comprehensive approach for future growth in instructional computing in the community colleges in the State of Washington. The first two sections define the curriculum objectives and content required for instructional courses in the community colleges which require access to computing facilities. Sections 4, 5, 6 and 7 define the software, hardware, peopleware, and other support required to adequately meet the identified course content and objectives. Section 8 presents the resource specifications and acquisition procedures which will permit the colleges to move from their present level of instructional computing to a more advanced level.

Each section specifically addresses the seven areas of instructional computing, which are:

(1) Data Processing Technology

(2) Problem Solving

(3) General Introduction to Computers and Computing

(4) Computer-Based Instruction (CBI)

(5) Computer-Managed Instruction (CMI)

(6) Computer-Assisted Instruction (CAI)

(7) Computer Science Major

The importance of the computer in today's community colleges cannot be overemphasized. The scope of its use includes every facet of operation from teaching and learning through administrative operations and community service.

The report on Computers in Higher Education, prepared by the President's Science Advisory Committee, emphasizes the role of the computer in the following excerpts:

(1) In all parts of education, government, or industry, digital computer use has come about because it is an effective tool.

(2) In attempting to assess the educational need for computers in colleges and universities, we find ourselves compelled to believe that by 1978 essentially all university and college students will require some basic understanding of digital computation.

(3) Every such institution will require on its staff enough faculty with computer experience to teach computer use and provide computer experience in various disciplines.

The use of computers in higher education can be dichotomized into two categories: use of the computer as a tool; and, study of the computer as a subject in its own right. In the first area, as a tool, the computer is identified with "academic" use as a problem solving aid, as a vehicle for simulation modeling and gaming, as a manager of learning, and as a "main line" and "adjunctive" aid in instruction for any activity.

As subject matter, the computer is identified with the vocationally-oriented data processing technology curriculum and the academic computer science major.

The community colleges in the State of Washington were among the first colleges in the nation to develop educational programs in data processing technology. These programs were established in 1962 through the combined efforts of the Division of Vocational Education, the colleges (which were vocational-technical schools and junior colleges at that time), and interested vendors. A recommended curriculum was developed and unit record equipment and IBM 1620 computers were installed in these schools during 1962-63. Funding for these instructional programs came primarily from the local school districts with assistance from vendors, in the form of a 60 percent educational discount on hardware, and from supplemental federal vocational education funds.

Vocational training programs were established and developed through the years by a number of colleges with the assistance and advice of local advisory committees representing data processing installations from local industry. Over the past twelve years, each of the thirteen approved vocational training programs has evolved by adapting its curriculum and hardware resources to meet the needs of the local communities. Therefore, while the same general subject areas are covered, each district currently offers a unique sequence of courses and instructional emphasis which varies by geographical area. For example, Columbia Basin Community College, in Pasco, is strongly influenced by the emphasis on scientific computing by local industry in the Tri-Cities area; Olympic College, in Bremerton, conducts an extensive evening program to meet the needs of employees of the various U.S. Naval installations; the instructional program at Centralia College is strongly oriented toward the state government employment market in Olympia; and, Clark College, in Vancouver, Washington, trains students for employment in the Portland Metropolitan Area.

Evolving from the vocational programs, generally, academic computing relied initially on the hardware, software, and peopleware associated with the vocational programs. With the growth and

accessibility of commercial time-sharing services and four-year college/university facilities, the community colleges began to expand problem solving, CBI, and general computing courses in their curricula about 1968. Utilizing a diverse collection of software and hardware resources, academic computing applications in the colleges now range from none to extensive. Some colleges, such as Lower Columbia College in Longview, have Chemistry CAI applications, Business and Management simulations, Mathematics and Statistics CMI systems, as well as introductory and programming courses. Others in the system are currently "have-nots" as computing is relatively non-existant on some campuses.

Hardware support, also, for the instructional programs is as varied and mixed as the programs being offered.

Many instructional programs, due to the obsolescence of their in-house hardware, have relied on purchased or donated time from service bureaus or private companies and other schools to provide students access to modern equipment.

Having as a requirement the provision of adequate education to those students enrolled in its institutions, the State of Washington has a specific obligation to provide adequate computing support for these students. Adequate computing support is directly related to skill requirements graduates must have to fill jobs in the late 70's and 80's. With the rapid increase in the numbers and uses of computers in society, there is pressure upon both the student and the institution of higher learning to increase their contact with computer resources and delivery mechanisms.

A few years ago, highly intelligent, well-trained technicians were about the only persons able to communicate effectively with computers. Today, computer systems are designed for use by persons from all walks of life, from all levels of intelligence and training. The rate of this acceleration is having a significant effect on the way of life in society.

By the year 1985, according to Martin and Norman (1970) in The Computerized Society, "there will be a sudden, massive spread of computer usage that will affect the lives of almost everyone." Attributing this spread are four factors:

(1) mass production of computer hardware at significantly lower cost

(2) standardization of software and application systems

(3) large data bases and rapid access storage devices

(4) telecommunication network extensions and expansion

These authors further contend that rapid changes in information technology open a wide range of possible futures for society.

Education must strive to increase knowledge and understanding of computers by society. Community colleges, having the greatest contact with the members of society, being the "educational institutions of the masses," have the greatest opportunity to provide the necessary learning experiences for the greatest number of people. No other institution has greater potential for developing the requisite understanding and knowledge to manage and plan the use of information technology for the betterment of society.

Until recently, community colleges of this state responded to the increased demand for computing education much in the same manner that other colleges across the nation responded — they sought to improve their condition on an individualized basis to the best of their abilities. The development and implementation of computer networks, however, have significantly expanded the alternatives facing the individual college in its search for methods to improve the quality and quantity of computing to its students at minimum cost. Technically feasible for several years, with attractive cost/benefit attributues, the network concept is revolutionizing college computing, according to G.P. Weeg in an address to the Pacific Northwest Cooperative Computer Center Annual Symposium held April 13, 1973, at Washington State University. Pointing out that networks exist in about twenty locations in the nation, most of them initiated under the auspices of NSF funding. Weeg states that these networks provide to smaller institutions computing support of a kind more potent than any small college could in any other way achieve. Since it appears that continuation of the trend toward development of individual computer centers to support the growing computing needs of each campus would exceed the capability of the funding source to support such ventures, it appears that the community colleges of this state should steer a course of future development that is consistent with the utilization of computer networks and distributed computing resources whenever practical.

Distributed computing systems are those systems which provide diverse and appropriate computer capability at geographically separated locations. Usually a computer network is involved in the distribution of such resources to remote users. A network consists, typically, of a central computer facility servicing remotely located terminals via a communications facility. Distributed computing systems may include networks, may include special-purpose dedicated computing facilities, or may include a combination of both network and dedicated facilities.

A number of educational computing network-based computer systems are currently reevaluating their systems relative to the impact of technological advances in computer terminals and minicomputers. The University of Iowa, for example, finding only 20

percent of its classes making use of the computer for instructional purposes (compared to 88 percent of the student-body at Dartmouth College) concluded that RJE batch systems were insufficient [illegible] in terms of supporting the developing needs for computing s[illegible]e within the institution. Iowa further concluded that time-sharing conversational computing facilities, free to the student, employing BASIC was necessary to enhance and improve the level of computing at their institution. It is interesting to note that the Iowa study, reported in ON-LINE, March, 1974, found that one computer terminal can optimally serve about 40 students who receive one computing assignment per week. Aiming at a 50 percent level of use by the student body, Iowa observed that it was economically and technologically feasible to install mini-computers interfaced to the central computer facility to provide the necessary computing support to reach the 50 percent figure. The minis at Iowa are connected to the central computer for batch RJE support. The minis are also used for access to the time-sharing capabilities of the host that exceed the capabilities of the mini; however, the minis are used to meet the bulk of time-sharing conversational computing demands.

The University of California at San Francisco has used computers in instruction for over 12 years, initially utilizing a second generation computer dedicated to a CAI system called COMPTEST. In 1962, a new system called PILOT was implemented when a large, centralized time-sharing facility became available. Recent advances in computer technology in the form of dedicated stand-alone, programmable computer terminals now allow UCSF to utilize "intelligent" programmable terminals off-line for special purpose CAI applications more efficiently and economically than on-line to the central computer, plus provides on-line capability for time-sharing on the central computer when necessary and appropriate.

The developments in the technology of programmable terminals and mini-computers allows the University of Iowa and the University of California at San Francisco to deliver necessary and appropriate computer support in a distributive fashion via centralized and remote facilities in an economical and efficient manner.

From the perspective of the small college, the distributed computing concept offers the potential to move from no computing to a fairly sophisticated level in a matter of a year or two, and by furthering cooperation between institutions, the distributed computing network gives the community colleges of Washington State a viable means of providing necessary and appropriate computing services to all in an economical and efficient manner.

# CURRICULUM OBJECTIVES

The community college curricular offerings in the area of instructional computing have as general objectives the following:

(1) Provide professional EDP career development programs so that graduates can be successfully placed in EDP entry-level positions.

(2) Furnish additional computer-related skills so that EDP graduates may be more competitive in their job seeking.

(3) Acquaint students with aspects of computing sufficient to provide an understanding of the role, use, limitations, and potential in society.

(4) Provide auxilliary computing courses sufficient to fulfill the need for problem solving by computer for all students.

(5) Provide computer-based, computer-assisted, and computer-managed support in order to enhance traditional course objectives.

The following sections describe in detail the curriculum and application objectives for each of the seven areas of community college instructional computing.

## I. DATA PROCESSING TECHNOLOGY

The studerts currently being served by the data processing technology programs in the Community College System can be divided into two distinct groups. First, there are those whose objective is to obtain a data processing position in industry and second, there are the students who begin in data processing, but either leave school or transfer to other majors.

The first group is comprised of data processing majors who will use their training in data processing positions in industry. They can be classified into three groups: (1) data entry operators; (2) digital computer operators; and (3) business computer programmers. These students spend a high percentage of their class hours in data processing classes with additional training added to improve their employability.

The second group is made up primarily of former data processing majors who have either changed majors after beginning in data processing, or who have left school but who are also more employable because of their data processing training. Curriculum

for these people will be the same as for the data processing major for as long as they are in the program. It is important that beginning courses be arranged so that these students gain as much skill as possible during their time in the data processing program.

A. DATA PROCESSING MAJORS

Most of the objectives and training requirements for this group of students has been extracted from the Occupational Analysis for: Business Data Processing Technology published June, 1972, by the Coordinating Council for Occupational Education of the State of Washington. These have been expanded based on current technology.

1. Data Entry Operator

   a. The ability to communicate effectively with other data processing personnel.

   b. The ability to prepare programs for data entry machines.

   c. The ability to prepare a program for a buffered data entry system.

   d. The ability to operate both buffered and non-buffered data entry machines.

   e. An understanding of a data processing system's "life cycle", i.e. the sequence of data flow through the data processing system.

   f. An understanding of computer hardware, software, and operating environment in order to perform effectively as a data entry operator.

   g. Ability to operate non-card data entry equipment (i.e. key-to-tape and key-disk).

   h. Experience in the operation of on-line data entry equipment.

2. Digital Computer Operator

   a. A comprehensive understanding of computer hardware, software, and operating environment in order to perform effectively.

   b. An understanding of a data processing system's "life cycle."

   c. At least 300 hours of hands-on experience prior to graduation.

d. Hands-on training on a state-of-the-art computer system.

e. An understanding of mini/micro computer systems.

f. Hands-on training on mini-micro computer and small business systems.

3. Computer Programmer (Two-Year Degree)

a. The ability to program effectively in a high-level business language, preferably ANSI COBOL.

b. The ability to perform basic computer operations functions.

c. Experience in assembly language coding.

d. A comprehensive understanding of computer hardware, software, and operating environment in order to perform effectively as a business programmer.

e. An understanding of the capabilities of large and small computing systems, e.g. multiprocessing and multiprogramming.

f. Basic data communication concepts and techniques, such as remote batch, time-sharing, direct access, and message switching.

g. An understanding of data file organization and access techniques.

h. An understanding of problem solution utilizing flowcharts, decision tables, translators, generators, programming structure, and fundamental process of analysis.

i. An in-depth understanding of a data processing system's "life cycle."

j. An understanding of data base management, data base file structure, the data base environment, and elements of a data base language.

k. The ability to program in an on-line environment.

l. An understanding of mini/micro computers and networks.

m. A knowledge of and experience with Computer-Assisted Instruction (CAI) as a learning tool.

n. Participation in an internship or work experience program.

B. DATA PROCESSING RELATED OCCUPATIONS

As previously stated, students in this category normally have not completed their data processing training. Typical jobs for these students include: (1) data control clerk; (2) tape librarian; (3) documentation librarian; and (4) EDP salespersons. Two levels of objectives are included. Level I is considered to be the minimum training to be effective in one of the preceding occupations. Level II objectives are recommended for those students who will have a greater degree of responsibility on the job.

Level I — Introduction to Data Processing

1. A comprehensive understanding of current computer hardware, software and operating environment in order to perform business functions in coordination with data processing personnel.

2. An understanding of the data processing system's "life cycle".

Level II — Introduction to Programming

1. A comprehensive understanding of current computer hardware, software, and operating environment in order to perform business functions in coordination with data processing personnel.

2. An understanding of the data processing system's "life cycle".

3. The ability to program effectively in at least one computer programming language.

The objectives presented in this section are suggested with respect to the currently identified needs of data processing installations in the State of Washington. They do not address all of the curriculum objectives that may be unique to an occupational program in a given geographical area. Each of the campuses offers a similar sequence of courses with instructional emphasis varying by geographical area and based upon the input of local technical advisory committees.

## II. PROBLEM SOLVING

Problem solving is the use of computing resources to define, describe, and solve those problems which can be expressed in arithmetic or logical notation. This type of problem is typically encountered in the business, natural science, social science and engineering curricula. Problem solving applications require a range of resources that span the entire spectrum of

software, hardware, and peopleware. The necessary computing resources are determined by the type of problem. With the advent of CAI, CMI, AND CBI, the techniques of problem solving can be extended into the humanities and other areas traditionally untouched by computer technology. This area is designed to support disciplines other than occupational data processing, the objectives and curriculum must be tailored to fit requirements of the individual disciplines. General objectives are suggested from which may be extracted those which will satisfy specific needs. Typical disciplines that have been supported include: (1) accounting; (2) banking programs; (3) education; (4) electronics; (5) engineering; (6) engineering technology (including drafting); (7) hotel/motel management; (8) management; (9) mathematics; (10) science; (11) secretarial science; (12) social science; (13) statistics; (14) allied health occupations; (15) business; and, a host of others.

In order to solve applications problems, the student will need to understand basic computer concepts, to have some programming skills, to understand computer-assisted problem-solving, and to know how to apply those methods to his major field.

Specific curriculum objectives are:

A. To teach a modern, high-level programming language where each student writes and processes several computer programs.

B. To use interactive time-sharing computer terminals as a training component where each student writes at least one program in a time-sharing mode.

C. To have computer facilities available for use in all instructional programs to:

   1. Provide sophisticated techniques of handling any subject matter;

   2. Expose students and faculty to new advances in data processing technology.

D. To offer a computer programming course which emphasizes problem solving techniques.

E. To provide real life situations for homework problems and student special projects via computer simulations.

F. To gain an understanding of problem solution utilizing flowcharts, decision tables, programming structure, and fundamental processes of anlaysis.

G. To enable the student to gain a knowledge of the capabilities of computing which will become increasingly important in gaining employment in a computer-oriented society.

H. To have video tapes, voice cassettes, and programmed instruction computer courses available for special interest or small classes.

## III. GENERAL INTRODUCTION TO COMPUTERS AND COMPUTING

General introduction to computers and computing covers those courses based on the following themes:

1. An overall view of the computer and its applications focused on the fundamental concepts of hardware and software.

2. A study of the impact of computer technology upon society and society's problems.

3. An investigation of the extent to which the usage of computers has dehumanized the individual and ways of counteracting these effects.

4. The future recreational and potential personal growth possibilities of computer development via games, music, artificial intelligence, etc.

Specific curriculum objectives are:

A. To provide a course on the computer and society to help the community adjust to and take advantage of computer technology.

B. To provide a single course that would sufficiently acquaint students with enough aspects of data processing so that students could enter any advanced data processing course or use data processing principles in other course work.

C. To offer a survey of courses in automated data processing including an orientation to computer processes, hardware and software.

D. To provide real life situations for homework problems and special projects via computer simulations.

E. To foster an awareness of how the computer works, what it can do, what it cannot do, how it is misused, and how to use this technological advancement in a human environment.

F. To gain an understanding of problem solution utilizing flowcharts, decision tables, programming structure, and fundamental processes of analysis.

G. To enable the student to gain a knowledge of the capabilities of computing which will become increasingly important in gaining employment in a computer-oriented society.

H. To obtain an understanding of a data processing system's "life cycle".

## IV. COMPUTER-BASED INSTRUCTION

Computer-based instruction is the adjunctive use of computer programs (models or simulations) to assist students by providing a vehicle for conveying knowledge, by allowing practice in applying concepts, and by increasing interest through active participation in analysis and decision making. Although computer-based instruction requires the use of a computer, no detailed knowledge of computers or computer languages is necessary, but rather a knowledge of factors influencing the model/simulation basic to the discipline itself. By using the computer to do some of the "busy work" in number computations, a student is given more time to test alternate decisions or to pursue analysis of the problem in greater depth. Also by seeing which decisions are made by which subset of the class, an instructor can evaluate his own effectiveness. It allows a student an introduction to the use of the computer in his own discipline. Current application have been developed in a variety of disciplines, e.g., business, economics, political science, chemistry, biology, forestry, mathematics, engineering, health services.

Most normal teaching methods consist of lecture, homework problems, tests, and in some areas, laboratory experience. While computer-based instruction does not relieve an instructor or student of responsibility in the traditional areas, it does provide an alternative exercise in the use of lecture and reading knowledge to problem solving. In a survey conducted at Lower Columbia Community College, of 158 students which had used CBI in a business course, 130 or 82 percent, found the use of CBI as "informative and enjoyable" while only 10 percent found CBI as "confusing or difficult." The application of theory to practice traditionally has been by either case studies or mathematical computation problems. A difficulty with the case study technique is that it isolates the general theory currently being taught by forcing too narrow a scope of application. Mathematical computations usually cannot be very sophisticated, particularly at the community college level. The computer-based simulation model avoids both of these difficulties by allowing the use of sophisticated computational procedures with a wide variety of problems. In essence, the computer does the arithmetic in a very rapid fashion, allowing the student to see results of his analyses and decisions many times during a course, rather than just once or in a very simplistic way.

Specific application objectives are:

A. To augment the normal teaching materials

B. To encourage the application of theory

C. To expand student interest in the discipline

# V. COMPUTER-MANAGED INSTRUCTION

Computers may be used in the management of the learning process in two ways. First, the computer is used as an aid in the monitoring and recording of student performance over learning objectives. In the second, the computer assists the instructor in testing and prescribing appropriate materials to each student.

Teachers must keep records of student performance and achievement and use the records for student and curriculum evaluation. The computer's clerical and analytical abilities are likely to be of value in these tasks, particularly when the classes are large in size.

The production and grading of tests, the analysis of their results, the evaluation of individual and group student performance, and class record keeping are among the most time-consuming and least-valued aspects of the instructional job. Research has shown that frequent testing with appropriate feedback of results enhances and increases comprehension and learning of material. Frequent testing, however, and immediate feedback of results are not often carried out at present due to the overwhelming demands on time and clerical resources necessary. The computer's inherent nature makes it a viable tool for managing the teaching-learning process.

Also, the computer can be used to help evaluate student areas of difficulty, and direct the student to remedial materials in order to facilitate his learning of the subject matter.

Management uses of computers in the learning-teaching process have the following set of objectives:

A. To enhance and support individualized instructional offerings, experiences, and evaluation techniques

B. To assist the instructor in determining curriculum objectives, in evaluating student performance, in reducing time-consuming clerical tasks done manually

C. To increase the relationship between course content, testing materials, and student self-evaluation of progress through each unit of learning

D. To reduce the dependence of the student on the instructor for testing, remedial references, and retesting

E. To improve the effectiveness with which course materials are conveyed to both large and small classes of students with a wide range of aptitudes and backgrounds

F. To increase the opportunity for common terminology, common course objectives, and common measurement instruments within the community college system.

## VI. COMPUTER-ASSISTED INSTRUCTION

Computer-assisted instruction involves the use of computing resources in the delivery and presentation of course content to the student.

CAI has as objectives:

A. To provide individualized instruction for each student with the flexibility to adapt to each student's unique learning characteristics.

B. To enhance teacher productivity.

C. To allow the instructor to concentrate on the human aspects of the student-teacher relationship.

D. To improve the quality of the learning process through increased motivation and deeper understanding of primary concepts.

The results of recent CAI trials and the scope and sophistication of some on-going programs including two major efforts to demonstrate the feasibility of CAI on a large-scale, suggest that a computer may indeed come to play an important role as teacher, though probably more slowly than originally anticipated.

## VII. COMPUTER SCIENCE MAJOR

Computer science is a field of inquiry devoted to the representation, storage, manipulation and presentation of information in an environment permitting automatic information systems. The computer scientist is interested in discovering the means by which information can be transformed in order to model and analyze the information transformations in the real world.

The objective of computer science education is to develop professionally competent and broadly educated computer scientists. At the undergraduate level, the preparation for entering a professional career or for pursuing graduate studies is provided. Undergraduate education is not designed to prepare students for specific jobs, but rather to provide the basic knowledge for any number of present and future jobs; especially important is a foundation that will not become obsolete as technology advances and changes.

# CURRICULUM CONTENT

Curriculum content guidelines which achieve the curriculum objectives for each of the seven areas of computing activity are presented in this chapter. Clearly, individual instructor perogative, local constraints and emphasis, plus student intent will tend to diversify curriculum content over the community college system. Therefore, it is expected that the curriculum content and application characteristics specified herein are to be used primarily as guidelines and not as absolutes.

## I. DATA PROCESSING TECHNOLOGY

The curriculum content and courses being offered by the occupational preparatory and occupational supplementary data processing programs must meet a wide variety of needs. As such, a given course must provide training for not only the data processing major, but for the student in other disciplines. This section will address typical courses being offered at the various community colleges. The matrix that follows indicates those courses and which of the curriculae are being satisfied by the specific course. Following that, each course will be discussed with respect to course objectives and content.

| | COURSES | CURRICULA SATISFIED | | | |
|---|---|---|---|---|---|
| | | DATA ENTRY | COMP OPERATION | COMP PROG. | SUPPORT |
| 1. | Data Entry/Recording Theory & Application | X | | | |
| 2. | Introduction to Data Processing | X | X | X | X |
| 3. | Computer Operations Theory & Application | | X | X | |
| 4. | Computer Programming Fundamentals | | X | X | X |
| 5. | Job Control Language & Operating Systems | | X | X | |
| 6. | Computer Programming/RPG | | X | X | |
| 7. | Computer Programming/ ANS COBOL | | X | X | X |
| 8. | Computer Programming/ ALC | | | X | |
| 9. | Systems Analysis | | | X | |
| 10. | Structured Programming | | | X | |
| 11. | Data Communications | | | X | |
| 12. | Computer Programming/ BASIC | | | X | X |
| 13. | Computer Programming/ FORTRAN | | | X | X |
| 14. | Computer Programming/ PL/1 | | | X | |
| 15. | Data Base Management | | | X | |
| 16. | Mini/Micro Computer ORIENTATION | | X | X | X |
| 17. | CBE AUTHOR LANGUAGE | | | | X |
| 18. | Internship/Work Experience | X | X | X | |

## A. CURRICULUM CONTENT GUIDELINES

### 1. Data Entry/Recording Theory and Applications

#### a. Course Objectives

At the completion of the course, the student should be able to:

(1) Power on and ready the data entry machine;
(2) Prepare a data entry program;
(3) Determine machine malfunction and recommend correction procedures;
(4) Key 10,000 strokes/hour with an error rate not exceeding 4 percent.

#### b. Course Content

Introduction to data entry/recording procedures; program preparation; familiarization with skills necessary for quick and safe operation of equipment; written and key tests; building of speed and accuracy; production work.

### 2. Introduction to Data Processing

#### a. Course Objectives

At the completion of this course, the student will be able to:

(1) Understand basic data processing terminology;
(2) Understand data flow concepts;
(3) Describe various methods of handling data including manual, electromechanical and computer-oriented approaches;
(4) Describe software, hardware and peopleware as related to data processing;
(5) Discuss some of the affects of the computer in society.

#### b. Course Content

Introduction to data processing terminology, unit record processing, computer hardware, computer software, problem-solving considerations, computer systems and applications, methods of accessing the computer, computers and society.

### 3. Computer Operations Theory and Application

#### a. Course Objectives

At the completion of the course, the student shall be able to perform the required tasks of a computer operator at the job entry level.

b. Course Content

Introduction to the functions of the console, central processing unit and input/output devices. Introduction to operating systems, power procedures, console operation, peripheral operation, work schedules, personnel safety, file maintenance, time utilization and work efficiency.

4. Computer Programming Fundamentals

a. Course Objectives

At the completion of this course, the student will be able to:

(1) Solve problems using algorithmic methods and flowcharting techniques.
(2) List and describe the operations and the major hardware components of a computer system.
(3) Convert decimal numbers, alphabetic and special characters into the computer representation of data for various computer models by the polynomial expansion method, BCD, and EBCDIC methods.
(4) Demonstrate comprehension of the BASIC computer language by writing and running on a computer at least five programs.
(5) Explain how computers have affected and may affect our society.
(6) Describe the function(s) of software in the total computer environment and discuss the more common languages utilized by computer programmers.

b. Course Content

Introduction to problem-solving, introduction to computer systems (hardware and software), computer information representation, computers and society, and the BASIC language.

5. Job Control Language and Operating Systems

a. Course Objectives

At the completion of this course, the student should be able to:

(1) Effectively use the library facilities of a given operating system;
(2) Use the file-to-file utilities of a given operating system;

(3) Code the control statements that will make efficient use of a sort program;
(4) Develop job streams using card, tape, and disk files.

b. Course Content

Introduction to operating systems, job management concepts, control statement techniques, system control and service programs, application programming considerations.

6. Computer Programming/RPG

a. Course Objectives

At the completion of this course, the student will be able to:

(1) Describe and use the various RPG coding specifications
(2) Write RPG programs having:
  (a) The four basic arithmetic functions;
  (b) Multiple level control breaks;
  (c) Table and file handling.
(3) Debug RPG programs using the diagnostics provided by the compiler.

b. Course Content

Introduction to RPG, RPG coding specifications, basic input/output, arithmetic statements, multiple level control breaks, table and file handling, and use of indicators.

7. ANS COBOL Language

a. Course Objectives

At the completion of this course, the student will be able to write programs using the COBOL language and its syntax that do the following:

(1) Perform data manipulation;
(2) Utilize the various file or organization techniques as they relate to card, printer, magnetic tape and direct access files;
(3) Program segmentation - to facilitate more efficient use of primary storage through the use of the segmentation feature of COBOL;
(4) Utilize the sort feature incorporating input and output procedures;

(5) Debug source and object programs using the debugging language, compile output, prepare flowcharts and read core dumps;

(6) Use structured programming techniques.

b. Course Content

Introduction to COBOL; COBOL fundamentals; table-handling, COBOL for tape devices, DASD organization, sort and subprogram concepts. It is recommended that this course be two quarters in length.

8. Computer Programming/Assembler Language

a. Course Objectives

At the completion of this course, the student will be able to:

(1) Describe the assembler language instruction set;
(2) Describe the various data structures and formats;
(3) Write assembler language programs using decimal and fixed-point instructions; and,
(4) Read a core dump.

b. Course Content

Introduction to assembler language, internal data representation and data structures; standard instruction set with emphasis on decimal and fixed-point operations; supervisor and I/O macros; reading of core dumps; program segmentation.

9. Systems Analysis

a. Course Objectives

At the completion of this course, the student should have an understanding of the duties of the systems analyst, together with an understanding of the specific methods and techniques for conducting a systems project, including the following phases:

(1) Preliminary investigation and feasibility study;
(2) Design of systems output;
(3) Design of systems input;
(4) Design of systems files;

(5) Design of systems processing;
(6) Design of systems controls;
(7) Systems project management;
(8) Programming specification;
(9) Programming, testing, and documentation;
(10) Systems implementation and evaluation.

b. Course Content

Role of the systems analyst; business as an information system; coding; forms design; charting techniques; flowcharting; communications; study phase, system performance; feasibility analysis; study phase report and review; system design.

10. Data Communications

a. Course Objectives

At the completion of this course, the student will be able to:

(1) Understand teleprocessing terminology;
(2) Describe various access methods to a computing facility;
(3) Design a simple teleprocessing system;
(4) Discuss equipment considerations relating to a proposed teleprocessing system; and,
(5) Write and execute interactive programs.

b. Course Content

Data communications equipment; signal characteristics; channel categories; modulation; transmission modes; common carriers; error detection; network structure and utilization.

11. Basic Language

a. Course Objectives

At the completion of this course, the student will be able to:

(1) Utilize a terminal (TTY, CRT, etc.) to send and receive the BASIC programs; and,
(2) Demonstrate comprehension of the BASIC language by writing and running on a computer at lease five application programs, including documentation.

b. Course Content

Introduction to computer and terminals; syntax of BASIC; use of library functions.

12. ANS FORTRAN IV Language

a. Course Objectives

At the completion of this course, the student will be able to:

(1) Describe and use the syntax of FORTRAN;
(2) Analyze, program, test, debug and document at least five FORTRAN programs; and,
(3) Prepare these programs and compile and execute them on a computer.

b. Course Content

The elements of FORTRAN; input and output; arithmetic programming; control programming; logical programming; arrays; sub-programs; and internal data representation. This assumes that the student has completed at least a college-level algebra course.

13. PL/I Language

a. Course Objectives

At the completion of this course, the student should be able to:

(1) Describe and use the syntax of PL/I;
(2) Read and explain a given program written in PL/I;
(3) Analyze, program, compile, test, debug and document several PL/I programs; and,
(4) Design a structured program using PL/I.

b. Course Content

Structural elements of PL/I input and output; data manipulation; computational and manipulative facilities of PL/I looping; program design based on structured programming.

14. Data Base Management

a. Course Objectives

At the completion of the course, the student will be able to:

(1) Define a data base;
(2) Define an outline architecture for a data base;
(3) Discuss the elements of a data base language;
(4) Discuss various physical organization methods of data base implementation; and,
(5) Update and retrieve data from a data base.

b. Course Content

Data management; data base environment and files; elements of a data base language; and the advantages and limitations of the "data base" approach.

15. Mini-and Micro-Computers

a. Course Objectives

At the completion of this course, the student will be able to:

(1) Understand and explain basic computer architecture and computer concepts as they relate to mini- and micro-computer systems;
(2) Use mini-computer and/or micro-computer program languages and techniques; and,
(3) Operate a typical mini- and/or micro-computer system.

b. Course Content

Computer concepts; mini-, micro- and large-scale computer architecture; mini-/micro-computer applications; programming languages and systems.

16. Author Languages

a. Course Objectives

Upon completion of this course, the student will be able to:

(1) Utilize a small programmed learning text consisting of a set of English based words that direct the computer;
(2) Know how author languages function and know the elements of a lesson; and,
(3) Develop a course using an author language.

b. Course Content

Various author languages; what an author language is; developing the elements of a lesson plan; planning on a computer; debugging and updating the course.

17. Internship/Work Experience

a. Course Objectives

At the completion of this course, the student will be able to:

(1) Analyze, develop and implement a specific data processing project;
(2) Apply current programming techniques with a minimum of supervision and instruction; and,
(3) Document the completed project.

b. Course Content

Provides advanced data processing students with actual work experience parallel to the actual job environment. Individual programs of work and classroom instructions are fitted to the student's needs and desires.

## II. PROBLEM-SOLVING COURSES

The curriculum content of problem-solving courses is based upon the utilization of a modern, high-level programming language. This necessitates acquiring the concept of problem identification, the formulation of an algorithm, and mastery of the syntax and logic of whatever programming language is being used. In addition to specific courses in problem solving and programming, educators are now finding that the computer can be utilized in virtually any academic discipline as a problem-solving tool.

Problem solving and the academic use of computers can be dichotomized into computer programming courses and courses which use computer programs.

### A. COMPUTER PROGRAMMING COURSES

Computer programming courses consist of Fundamentals of Computer Programming, BASIC Programming, FORTRAN Programming, and COBOL Programming.

1. Fundamentals of Computer Programming

a. Course Objectives

At the completion of this course, the student will have a working knowledge of the following programming concepts:

(1) Listing and describing the operations and basic hardware components of a computer system (input devices, compilers, CPU, output devices and other peripheral equipment);
(2) Utilization of a terminal (TTY, CRT, etc.) for interactive computing and methods of batch mode processing;
(3) Problem-solving techniques (problem identification, problem analysis, algorithmic processes, flowcharting, program structure, coding, program execution and program debugging;
(4) Machine languages and programming languages including the ability to write a simple program in at least one modern programming language (BASIC, FORTRAN, COBOL, etc.); and,
(5) The ability to apply those concepts to the solution of simple business-type problems.

b. Course Content

Elementary programming concepts including problem analysis and an introduction to a modern programming language. A brief introduction to automated data processing covering the basics of computer hardware and software.

2. Basic Programming

a. Course Objectives

At the completion of this course, the student will have a working knowledge of the following programming concepts as applied through the BASIC language:

(1) The utilization of a terminal (TTY, CRT, etc.) to prepare and submit a computer program;
(2) The basic components of a computer system (input/output devices, compilers, CPU, and other peripheral equipment such as graphics terminals and plotters);
(3) The source program and the object program;
(4) Errors (syntax, logical and blunder);
(5) BASIC statements (REMARK, assignment, conditional transfer, unconditional transfer, input, output, STOP and END);
(6) Programming concepts (line numbers, constants, variables, expressions, arith-

metic operators, relational operators, loops, subscripted variables, functions and sub-routines);
(7) BASIC commands (LIST, SCRATCH and RUN); and,
(8) Solution of practical problems by writing computer programs (flowcharting, writing, coding and debugging).

b. Course Content

An introduction to computer programming emphasizing the use of the computer as a tool for problem solving. Programs are written in the BASIC language and processed in either an interactive or batch mode.

3. FORTRAN Programming

a. Course Objectives

At the completion of this course, the student will have a working knowledge of the following programming concepts as applied in the FORTRAN IV language:

(1) Preparation and submission of a computer program via an interactive mode (TTY, CRT, etc.) or batch mode;
(2) The basic components of a computer system (input/output devices, compilers, CPU, and other peripheral equipment such as graphics terminals and plotters);
(3) The source program and the object program;
(4) Errors (syntax, logical and blunder);
(5) FORTRAN statements (COMMENT, ASSIGNMENT, CONTINUATION, DIMENSION, unconditional transfer, arithmetic IF, logical IF, computed GO TO, DO, FORMAT, input, output, STOP, RETURN, and END);
(6) Programming concepts (labels, constants [real, integer, string], data variables [real, integer, string], expressions, operators [arithmetic, relational, logical], loops, arrays, functions and sub-routines);
(7) Analyzing flowchart; write, code and debug a minimum of five FORTRAN programs; and,
(8) Preparing through key-punch or edit file these programs and compiling and executing on a computer.

b. Course Content

An introduction to the FORTRAN programming language and its application to the solution of problems in the areas of business, mathematics and other natural and social sciences.

4. COBOL Programming

a. Course Objectives

At the completion of this course, the student will have a working knowledge of the following programming concepts as applied in the ANSI COBOL language:

(1) Preparation and submission of a computer program in the batch mode;
(2) The basic components of a computer system (input devices, computers, CPU, output devices and other peripheral equipment);
(3) The source program and the object program;
(4) Errors (syntax, logical and blunder);
(5) COBOL statements (simple, compound, imperative, conditional, input [OPEN, READ, ACCEPT], output [WRITE, CLOSE, DISPLAY], arithmetic [ADD, SUBTRACT, MULTIPLY, DIVIDE, COMPUTE], data transmission [MOVE, EXAMINE], sequence control [GO TO, PERFORM, ALTER, STOP], run and end);
(6) Programming concepts (characters, names [data procedure, condition, special], works, constants [literal, figurative], operators [arithmetic expression, relational expression, logical expression], punctuation symbols, sheet format, sequence numbers, continuation, divisions [identification, environment, data, procedure], sections, paragraphs and entries);
(7) Utilize various file organization techniques as they relate to card, printer, magnetic tape and direct-access files;
(8) Debug source and object programs using the debugging language, compile output, prepare flowcharts and read core dumps; and,
(9) An introduction to the ANSI COBOL programming language and its application to the solution of typical business problems. Emphasis on magnetic disk file organization and magnetic tape processing.

b. Course Content

An introduction to the ANSI COBOL programming language and its application to the solution of typical business problems. Emphasis on magnetic disk file organization and magnetic tape processing.

B. COURSES WHICH USE COMPUTER PROGRAMS

Following is a selected list of subject areas and several computer applications for each area. The primary uses of the computer in classes other than mathematics are for problem solving, simulation, and drill/tutorial. All of the computer programs suggested are already in various existing libraries. Few examples are given in mathematics because they are so numerous, and most mathematics instructors are aware of the computer capabilities within their discipline.

1. Art: Computer animated films; computer-aided graphics as an art form; the microfilm plotter and computer art;

2. Biology: Heredity; photosynthesis; pest control; genetic modules; enzyme action; computing in animal physiology; testing program in audio-tutorial biology; prey-predator simulation and analysis; data analysis; pollution models;

3. Business: Inventory; depreciation; tax models; budget forecasting; bank statements; invoicing; mortgages; interest; economic models; population and economic growth; mathematics of finance; simulation of financial statements;

4. Calculus: Newton's method; curve fitting; numerical integration; numerical differentiation; approximation of functions;

5. Chemistry: Data analysis; chemical equilibrium; testing of chemical names and formulas; aromatic organic synthesis; conversions; titration; enzyme reactions; CAI and CBI in organic chemistry;

6. Education: CAI in early identification of handicapped children;

7. English: Simulation of poetry explication; synonym drill; computer teaching of literary stylistics; "From Poetry to Politics"; CAI in linguistic theory;

8. Foreign Language: Computer-generated video-tape for teaching French grammar; drilling Spanish verb forms; sentence generation through visual cues; computer-supplemented Latin instruction; conjugation drill; Spanish vocabulary drill;

9. Game Theory: Dynamics of environmental systems; urban planning; qualitative organic identification; economic policies; comparative shopping; city government;

10. Music: CAI in music theory; synthesizers and the physics of music; digital system for the instruction, composition and performance of music; an interactive computer music system;

11. Physics: Computer graphics; geometrical optics; wave motion; simulated projectile motion; simulated thermodynamics;

12. Psychology: Simulation of psychotherapy results; computer applications in experimental psychology; training in experimental inquiry;

13. Social Sciences: Population dynamics; election models and prediction; political simulation models; analysis of survey data; CAI in American history; teaching spatial organization;

14. Statistics: Monte Carlo experiments; hypothesis testing; regression analysis; correlation; descriptive statistics; analysis of variance.

## III. GENERAL INTRODUCTION TO COMPUTERS AND COMPUTING

Any student, no matter what discipline, may benefit from a knowledge of computers, computing, and electronic data processing. An understanding of the concepts and applications of computers and automation to the problems and processes of modern civilization should be a part of general education. Some knowledge of computers and programming concepts will be necessary to function in the modern business world and to function as a citizen and consumer in the society of the future. It is essential that an individual understand the capabilities and limitations of computers, as well as their impact on economics, technology and individuality.

### A. INTRODUCTION TO DATA PROCESSING

#### 1. Course Objectives

At the completion of this course, the student will have a knowledge of the following data processing concepts:

a. Basic data processing terminology;

b. The history and evolution of computers;

c. Decision-making processes;

d. Systems analysis and design;

e. Program flowcharting;

f. Unit record data processing (reproducer, interpreter, sorter, collator, calculator, and tabulator);

g. Input/output devices;

h. Computer hardware and software;

i. Data entry systems;

j. Various methods of handling data, including manual, electromechanical and computer-oriented approaches; and,

k. The data processing cycle.

2. Course Content

Basic methods, techniques, and systems of manual, mechanical and electronic data processing principles. Fundamental methods and techniques of punched card and magnetic disk systems; unit record processing; computer hardware and software.

B. COMPUTERS AND SOCIETY

1. Course Objectives

At the completion of this course, the student will have a knowledge of the following computer concepts:

a. The history of the computer and an understanding of computer systems;

b. Representation of information and processes;

c. Language and information retrieval;

d. Models and simulation;

e. Computers and education;

f. Games, logic and the computer;

g. Thought processes and artificial intelligence;

h. Automation and the economics of computers;

i. Computers and social responsibility;

j. The computer and an individual's right to privacy.

2. Course Content

A general course investigating the capabilities, limitations and problems associated with computers. An important objective is to acquaint the student with the vocabulary, major concepts and the social implications of the computer.

C. INTRODUCTION TO COMPUTERS, COMPUTING AND COMPUTER SCIENCE

1. Course Objectives

At the completion of this course, the student will have a working knowledge of the following concepts:

a. The operations and basic hardware components of a computer system (input devices, compilers, CPU, output devices and other peripheral equipment);

b. The utilization of a terminal (TTY, CRT, etc.) for interactive computing and methods of batch mode computing;

c. Problem-solving techniques (problem identification, problem analysis, algorithmic processes, flowcharting, program structure, coding, program execution and program debugging);

d. Machine languages and programming languages, including the ability to write a simple program in one modern programming language (BASIC, FORTRAN, COBOL);

e. The ability to apply these concepts to the solution of a simple problem; and,

f. The history and evolution of computers.

2. Course Content

Emphasis on the basic computing system, organization of the most important computers, hardware and software features of the most popular computers and comparison of computer systems. Elementary programming concepts, including problem analysis and an introduction to a modern programming language.

## IV. COMPUTER-BASED INSTRUCTION (CBI) - APPLICATION CHARACTERISTICS

Computer-based instruction is generally defined as the use of specialized computer programs such as simulators, emulators, and models as tools to support the instruction of traditional disciplines such as economics, business, engineering, forestry, and health education. As a simulator of the "real world", the computer is used as a vehicle for processing a mathematical model of the environment which is the subject matter of the course. The course content is primarily based upon the simulated environment created in the mathematical model. According to Naylor, et. al. (1966):

> *"Simulation is a numerical technique for conducting experiments on a digital computer, which involves certain types of mathematical and logical models that describe the behavior of a business or economic system (or some component thereof) over extended periods of time." (Naylor, T.H., J.L. Bolintfy, D.S. Burdick, and K. Chy, "Computer Simulation Techniques," New York: John Wiley and Sons, 1966)*

In short, computer-based instructional applications consist of computer models that are important adjuncts to the instructional process in at least three ways. First, they provide a means for conveying to the students a body of substantive knowledge. Second, they enable the student to practice applying his theoretical knowledge in a realistic environment, closely resembling real-life situations. Third, they heighten the student's interest in the subject matter.

## V. COMPUTER-MANAGED INSTRUCTION (CMI) - APPLICATION CHARACTERISTICS

Computer-managed instructional applications participate in the instructional process by affecting and organizing each step of the process. CMI provides information on the basis of which instructional-sequence decisions can be made. There are four characteristics of any computer-managed instruction system:

A. A file of student characteristics and performance;

B. A set of diagnostic examinations;

C. A set of instructional segments or modules; and,

D. A computing resource that uses data on student characteristics and performance through diagnostic examinations to prescribe an appropriate instructional module.

Computer-managed instruction differs from computer-assisted instruction in that CMI is adjunctive to the learning process, not the vehicle for presentation of course content as is CAI. CMI differs from CBI in that CMI manages and directs the sequence of learning events, and then records the progress of each student through the sequence. CBI does not include the management or recording of progress.

## VI. COMPUTER-ASSISTED INSTRUCTION (CAI) - APPLICATION CHARACTERISTICS

The term CAI is reserved for applications in which the computer program controls the amount and sequencing of information given the student through direct student/program interaction. The CAI computer program itself is designed to drill or teach the student. The CAI program provides drill through a sophisticated form of programmed instruction (PI). A frame of information followed by a question is presented to the student either on a typewriter or on the display device (CRT or plasma display tube). The student responds via the typewriter, or with light pen; and based on his response data, he receives feedback concerning his answer followed by further information.

The potential for flexibility in a CAI program is almost unlimited. Unfortunately, the reality falls far short of the potential. Suppes (1969) identifies three levels of CAI according to the degree and complexity of student-program interaction. These are (a) drill and practice, (b) tutorial, and (c) dialogue.

### A. DRILL AND PRACTICE

When the computer is used to provide drill in a skill such as addition or spelling, the lowest level of student-program interaction is involved. A problem is given the student; he responds; he is told whether or not he is correct; and he is given a new problem. Most existing CAI programs are at this level.

### B. TUTORIAL

A CAI program designed to teach a concept, value or skill is classified as tutorial. CAI tutorial programs borrow heavily from the theory of programmed instruction (PI). CAI does have many (potential) advantages over PI in speed of branching, gathering of data for branching, collection of student performance data and ease of revision.

C. DIALOGUE

The dialogue level of CAI "exists primarily at the conceptual rather than the operational level," according to Dr. Suppes (1969). Emphasis will be on cognitive learning at complex levels, such as heuristics, analysis, and synthesis. Provisions can also be made for voice and/or Braille communication between the student and the computer. This will help the handicapped student.

Students need drill and repetition to learn most concepts and skills. The amount needed varies among students on a given concept. A good CAI program must provide enough drill for any student, but should not require drill beyond a student's needs. A fairly sophisticated program, developed and refined based on large amounts of formative data, is need to do this effectively.

Implementing CAI at the drill and practice level will most likely occur before the other two levels, since it is the least costly to develop. A fairly substantial body of programmed instruction research has been built up in the last 15 years. Most of the results are directly applicable to CAI--results such as the value of low error rate, immediate feedback to the student, and active involvement of students in the instructional process. Furthermore, techniques for program development, revision, and evaluation in PI can be used in CAI.

The implementation of CAI in mainline instruction, i.e., replacing some or all of the usual teaching staff, has proven to be a task of major magnitude. Costs of program development per hour of tutorial instruction run as high as $20,000. At best, using resources currently available, good tutorial programs can be produced for somewhere in the neighborhood of $3,000 per hour, according to C. Victor Bunderson (1970). This assumes the existence of languages, systems, and authoring techniques that are still in the development stages.

The justification for the time and expense required to develop high quality CAI programs comes from the potential for greatly increased effectiveness and the economics of mass distribution. CAI evaluation studies have shown that students usually do at least as well under CAI as under traditional methods. One should not expect to be able to measure striking improvements in the performance of the better college students by means of CAI. "A" students will work until they get "A's"; "B" students "B's"; and other students until they reach their level of aspiration. It is difficult to measure the time and effort they spend outside of class or outside of CAI to accomplish this. The most striking finding in CAI evaluation studies has been

that students are able to achieve educational objectives in much less time. Savings of 40 percent or more are not uncommon (Fort and Slough, 1970; Homeyer, 1970; Hollen, Bunderson, and Dunham, 1968). This increased efficiency has important economic implications for education. Another important finding is that lower ability students are able to achieve important performance gains by means of CAI, often approaching the same levels as the higher ability students.

Students are able to progress rapidly in learning those skills in which they are diagnosed as being deficient. Students at all levels of ability, except the highest, showed gain from pre-test to post-test, with the more deficient students showing the most gain. Attitude toward the experience varied widely, with most students being favorably disposed. We have some evidence that the more negative attitudes were found among the poorer students, whose adjustment of any kind of concentrated study has not been good.

Few attempts have been made to implement CAI at the dialogue level. Current hardware and software capabilities appear to be sufficient to provide support at this level; however, the extra time and costs due to the more complex programming requirements have been strong deterrents to advancement in this area.

## VII. COMPUTER SCIENCE MAJOR

Computer science majors primarily study the means by which information can be transformed in order to model and analyze the information transformations in the "real world."

This interest leads to inquiry into the theory of (a) effective ways to represent information of all forms, (b) effective algorithm to transform information, (c) effective languages with which to express algorithms, (d) effective hardware and software processors to execute algorithms, (e) effective means to monitor the process and display the transformed information, and (f) economic ways to accomplish the above.

The study of computing system architecture is clearly in the realm of the computer science specialist; the study of algorithms is also an area with great breadth and general educational impact. This is expressed eloquently by D.E. Knuth, as follows:

> *"A person well-trained in computer science knows how to deal with algorithms: how to construct them, manipulate them, understand them. This knowledge prepares him for much more than writing good computer*

*programs; it is a general-purpose mental tool which will be a definite aid to his understanding of other subjects, whether they be chemistry, linguistics, or music. The reason for this may be understood in the following way: It has often been said that a person does not really understand something until he teaches it to someone else. Actually, a person does not really understand something until he can teach it to a computer, i.e., express it as an algorithm. 'The automatic computer really forces that precision of thinking which is alleged to be a product of any study of mathematics.' The attempt to formalize things as algorithms leads to a much deeper understanding than if we simply try to comprehend things in the traditional way."*

Although computer science courses are not now well defined in the community college system, some data processing technology courses are being utilized for the purpose of computer science transfer programs. Computer science, a developing discipline, may soon become a viable program in the community colleges.

SOFTWARE SUPPORT REQUIRED

# SOFTWARE SUPPORT REQUIRED

Computer software required for instructional computing in the community colleges consists of computer programs, operating systems, and data sets necessary to support the seven categories of application. Although each curriculum or application, from data processing technology to computer-assisted instruction, is relatively distinct, it is not the case that software resources required to support these areas need be distinct. In fact, it may be the case that the same FORTRAN compiler, for example, may support (in part) all of the areas.

Clearly, the data processing technology curriculum has need for a wider variety of software than any of the other areas. It has been observed that any software set capable of supporting a well-founded data processing technology curriculum will support most of the other areas also.

This chapter defines the necessary software for minimum support to each of the areas of instructional computing in the community colleges.

## I. DATA PROCESSING TECHNOLOGY

### A. DATA ENTRY/RECORDING THEORY AND APPLICATION

Specific compilers and features of given operating systems are not important in this particular area. But it is necessary to have proprietary software available in order to perform an analysis on the number of key strokes per hour. This type of software is normally written by the specific college offering a data entry program and is run on the local computing facility.

### B. INTRODUCTION TO DATA PROCESSING

Again, this course does not require specific software. However, demonstration software packages, games and simulation models are desirable for the purpose of introducing data processing concents to the novice.

### C. COMPUTER OPERATIONS THEORY AND APPLICATION

Students enrolled in this program of study require "hands-on" experience as part of their training. As such, specific pieces of software are not as important as general software which includes:

(1) an operating system, (2) production runs and procedures, (3) sort and file-to-file utilities, and (4) drill and practice software to aid the student in console operations and responses.

D. COMPUTER PROGRAMMING FUNDAMENTALS

Software required for this type of course primarily depends upon which computer language has been chosen as the vehicle to introduce programming fundamentals. The language most commonly used in the thirteen schools for introductory programs is the BASIC language. Therefore, an interactive BASIC compiler or interpreter would be required. Those schools using a language other than BASIC, however, would have a need for a different compiler.

E. JOB CONTROL LANGUAGE AND OPERATING SYSTEMS

The software required for this course is primarily related to that provided by a comprehensive operating system. As part of an operating system (or externally supplied by means of software packages), software required includes: (1) system library facilities, (2) file-to-file utilities, and (3) sort/merge. Examples of appropriate operating systems include: DOS (disk operating system), OS (operating system), or combinations such as DOS/VS or OS/VS (virtual storage).

F. COMPUTER PROGRAMMING/RPG

Although a standard RPG compiler is probably adequate for this course, an RPG II compiler is highly desireable. This is due to an abundance of requests from both students and industry to provide training in RPG II.

G. COMPUTER PROGRAMMING/ANS COBOL

Required software for this course is an ANS COBOL compiler. The compiler should include special COBOL features such as the SORT verb, report writer and debugging facilities.

H. COMPUTER PROGRAMMING/ASSEMBLER LANGUAGE

Any assembler language compiler would be considered adequate for this course. The purpose of this course is to provide instruction in low-level symbolic language. Traditionally, however, the BAL language and associated compiler has been used.

I. SYSTEMS ANALYSIS

Specific software is not required for this course, but sufficient software to design and implement comprehensive business application systems is necessary. ANS COBOL is desirable.

J. DATA COMMUNICATIONS

Required for this course are both a compiler supporting conversational programming and an interactive text editor. Examples are interactive BASIC and WYLBUR (as used at the WSU Service Center).

K. COMPUTER PROGRAMMING/BASIC

An interactive BASIC compiler or interpreter is necessary.

L. COMPUTER PROGRAMMING/FORTRAN

A full FORTRAN IV or ANS FORTRAN compiler is required.

M. COMPUTER PROGRAMMING/PL/I

A PL/I compiler is a minimum requirement, but PL/C is highly desirable.

N. DATA BASE MANAGEMENT

Although this course may be approached from the theory standpoint, it is recommended that a data base management system be available for use. Such DMBS packages recommended include: (1) TOTAL, (2) ADABAS, (3) IMS, or (4) MARK IV.

O. MINI-/MICRO-COMPUTER ORIENTATION

Depending upon which mini- or micro-computer is used for the study, all of the software which is a part of that mini- or micro-computer system would be necessary. Specifically, a compiler such as BASIC or FORTRAN is desirable, as well as the operating system components for a selected mini- or micro-computer system.

P. AUTHOR LANGUAGES

Any author language package that requires a minimum amount of programming effort for the user is adequate.

Specific examples include: (1) TICCIT, (2) PLATO, (3) PILOT, (4) ABLE, or (5) COURSE WRITER III. A language of this type should be available at the computing resource.

Q. INTERNSHIP/WORK EXPERIENCE

This course, like systems analysis, does not require specific software. However, for a complete project to be designed and implemented under the internship program, a computing resource with a sizable program library is necessary. ANS COBOL is also desirable.

Specific software is required for the majority of the data processing technology courses. For the most part, a computing facility oriented toward a production environment would possess most of the software required. Access to these resources must be made available for those colleges offering data processing training.

## II. ACADEMIC CURRICULUM

Software support is relatively the same for problem solving and general introductory courses as it is for CAI, CMI, and CBI applications. The computer science major requires a software set similar to that of the data processing technology program. It should be recognized, however, that general introductory courses may require little or no software depending upon the instructional method. Also, CBI, CAI, and CMI may require large computer programs installed in a large computing facility or small proprietary programs installed on individual classroon hardware teaching/learning stations.

Problem solving courses require the availability of compilers and/or interpreters for the FORTRAN, COBOL, and BASIC computer languages. The courses may also require the use of simulations and scientific and statistical sub-routines. It is expected that most large computer centers will have a sizable library of simulation packages in the areas of marketing, finance, accounting, business policies, economics, sociology, and physical science. Also, it is probable that many instructors will want to run specific vendor-supplied programs to which they have access. These programs are almost always supplied in source code form in either FORTRAN, COBOL, BASIC, or PL/I program languages--another reason to make available these processors.

Since most student jobs for problem solving are in the "load and go" mode, it is necessary to have in-core compilers for each of the languages for academic processing.

Computer-based simulation models are usually written in FORTRAN when processed in a batch mode and are written in BASIC if implemented interactively. Necessary software for CBI includes, then: FORTRAN and/or BASIC compilers, plus any specific simulation models such as MARKETING STRATEGY by Louis Boone and INTEGRATED SIMULATION by Nye, Estey and Vines. CBI "canned" programs (pre-written and pre-tested) are usually available as an instructional aid purchased with test materials, although some programs must be purchased or leased separately.

Computer software necessary to support CMI applications ranges from already-developed "canned" programs and systems to batch and interactive compilers such as FORTRAN and BASIC for development of CMI packages. For the community colleges, access to state host centers via slow-speed conversational devices and high-speed batch devices allows adequate software availability for use of most CMI packages. Some CMI systems in operation at non-host sites may require modifications to be operational at host, regional, or campus centers. Also, some self-contained, programmable terminals with pseudo-software facilities have CMI capabilities.

CAI software is divided into three parts: (1) operating systems, (2) application software, and (3) authoring software. The operating system software is concerned with task scheduling, disk management, and message handling. A general purpose operating system should be efficient enough to handle the large number of terminals necessary to deliver instruction in a cost-effective manner. The applications software runs under the operating system and provides the specific CAI functions. Author software is a specific collection of special languages used for writing lessons. Currently operational examples of CAI software are:

A. PLATO - University of Illinois

B. TICCIT - Metre Corporation and Brigham Young University

C. PILOT - University of California at San Francisco

D. PLANIT - Washington State University

E. TIME - McDonald Douglas Automation at Washington State University

These software systems provide drill and practice and tutorial CAI experiences for students at institutions across the nation.

# HARDWARE SUPPORT REQUIRED

# HARDWARE SUPPORT REQUIRED

Although hardware (the computer terminals, plotters, graphics display units, card readers, printers, punchers, etc.) has often been a subject of over-concern, it is nevertheless essential that appropriate hardware be available on a campus in sufficient numbers to support the software systems being employed in the curriculum. It is not difficult to identify a minimum complement of hardware devices necessary to support a given number of students. Clearly, if a college engages in instructional computing activities that require printed reports, a device capable of printing reports is necessary. If a college engages in activities requiring conversational, interactive experience for students, then one or more interactive conversational terminals is required. The same logic can be applied to graphics and plotting activities--graphics display and plotter units will be necessary.

The following sections identify those hardware resources necessary to support the software utilized in community college instructional computing.

## I. DATA PROCESSING TECHNOLOGY

Although there is a multiplicity of computer manufacturers and state resources from which to choose, it is not within the scope of this document to recommend a particular model or vendor. Each college offering training in data processing technology must give careful consideration to total instructional use of the computing facility and its particular requirements to properly evaluate the most suitable unit, or to determine the suitability of utilizing some other computer on a time-shared basis.

However, one consideration should be foremost. If a community college is currently offering a technical program for business applications programmers and computer operators, it must make available the computer generation predominantly in use in the data processing industry. To attempt to train programmers for today's market with yesterday's equipment is unsatisfactory and cannot produce the training level required. A commitment to train must include a commitment to proper computing resources. Not only is access to a modern computer facility imperative, but so, too, is exposure to an operating system environment. These requirements must be met in order to offer viable programs consistent with state-of-the-art technology.

A computer system that is capable of providing minimal learning experiences must be able to provide a number of systems, languages, and file processing capabilities. These would include software requirements identified in the previous chapter.

Hardware considerations will be based primarily on the institutions commitment toward integrating the computer throughout the institution. The two-year data processing curriculum will not require that sophisticated equipment be located on-site, but rather that the students have access to this equipment. For a training program oriented toward computer operations, "hands-on" training is considered a must. Therefore, a computing facility must be close enough for the student to have physical access. Data entry students, too, must have access to modern data entry equipment, as specified by local advisory committees.

Specific requirements of the computing resource are:

A. Sufficient internal core storage to utilize those compilers and packages defined in the previous chapter.

B. Magnetic tape and disk peripherals to provide the student with file processing, sort and on-line storage experience.

C. Adequate turnaround time so as not to disrupt the educational process. An acceptable level would range from immediate turnaround to no more than 12 hours, with a desirable average of approximately three to four hours.

The means of access to the computing facility are varied. They include:

A. On-site computing facilities;

B. High-speed RJE equipment;

C. Low-speed terminals (CRT's and TTY's); and,

D. Any combination of the above.

Exactly what hardware capability is needed by the various community colleges with occupational programs depends upon the particular circumstances of the school. Many of the existing programs have a need to upgrade their hardware, while others do not. Therefore, it will be incumbent upon each college that requires new or additional equipment to follow the resource acquisition procedures outlined in the section entitled, "Resource Specifications and Acquisition Procedures."

# II. ACADEMIC COMPUTING

Hardware support for academic computing activities ranges from almost none to the remote job-entry mini-computer supporting low-speed terminals. Required access is to a spectrum of on-campus and host hardware that spans the entire width of instructional computing. For the general introductory and problem-solving sources, a low-speed terminal and/or a remote batch entry card input, line-print output device may be necessary on campus. Host facilities should be large enough to allow storage of programs and data files in CBI, CMI, and CAI. Slow-speed terminals, plotters, and graphics display terminals may be connected to remote host facilities with appropriate hardware. Optionally, transmission of data and information can be performed by bus, train, or plane. Generally, the computer-science curriculum requires the same facilities available to the data processing technology curriculum.

The major concern of problem-solving activities is having an adequate number of teaching stations (terminals) to allow students adequate access to the computer with reasonable turn-around time.

Turnaround requirements vary course by course. Because of the student learning curve, however, the quicker the turnaround, the greater the utilization of the facilities will be.

Primarily, since most languages are supported in an interactive, conversational environment, most problem-solving applications will be via teletype or similar terminals to a remote host.

Also possible, due to the developing programmable terminal and mini-/micro-computer technology, is the self-contained, interactive programmable device that supports BASIC and other languages or applications. It is possible that a combination of remote, interactive terminals and self-contained programmable terminals/mini's/micro's will satisfy the problem-solving activities of a campus.

Colleges should also have access via batch facilities to large volume I/O processing for certain problem-solving applications and CBI simulations that require card input and line printer output of significant volume.

Necessary hardware to support CMI applications in the community colleges range from a slow-speed terminal connected to a state host to a regional center serving two or more colleges--that is, hardware ranges from level 1 - classroom stations through level 3 - regional centers, depending upon the level of sophistication and use. (See Section III for description) In some cases, all

that is necessary is a terminal to a host center or regional center; in others, a self-contained, programmable terminal or a campus center capable of local interactive processing will be required.

The hardware required to support CAI can vary from self-contained, programmable terminals to stand-alone mini- or micro-computers to remote host systems accessed via interactive terminals. However, for other than drill and practice CAI applications, hardware support of CAI is likely to be expensive.

Hardware requirements for the computer science major include access to computing power capable of supporting the necessary software. This may be achieved by an in-house system or by teleprocessing. The additional support of a mini- or micro-computer is desirable and useful, but not necessary. In many cases, the combination of a mini- or micro-computer as a control device in teleprocessing has proven an effective tool for study.

## III. STRATIFIED DELIVERY SYSTEM

Colleges wishing to utilize computing facilities for instruction find the following alternatives available: (1) they can establish their own local computer facilities, (2) they can participate in a remote computing cooperative, or (3) they can utilize a combination of both local and remote facilities.

Advantages of establishing a local computing facility include control of software and hardware facilities, hours of operation, fixed cost for unlimited use, self-determination in direction and philosophy of computing on the campus. The advantage of fixed cost for unlimited use becomes significant where interactive computing exercises are being conducted on a large scale. Disadvantages of small computing systems include inability to support applications and environments that require a large, sophisticated software system, high costs of acquisition and maintenance for other than very small systems, and personnel costs incurred in developing adequate staffing.

The second alternative provides educational computing services to students through terminals connected to a large host computer via telephone communications network. This approach has several advantages. First, the amount of computing power to be supplied to a given school can be easily tailored to the amount of funds that are available. Second, the institution does not have to assume the task of administering and developing a large-scale computing system. Third, every student has the advantage of being able to call on the most sophisticated software systems, a feature that most institutions cannot supply on their own with small systems.

Actual experience has shown that a single terminal can expose computing to hundreds of students during the course of an academic year. However, deeper involvement in computing with more frequent exercises will require additional terminal facilities. The primary disadvantage of employing remote terminals connected to a large-scale host facility is the high hourly computer and line costs incurred for relatively simple applications. For many applications involving the host accessed via terminals, the sophistication required is less than what is available. Hence, costs may be higher than necessary for these simplistic applications. A second disadvantage is that the amount of computing power supplied to a given college is limited by that college's ability to pay. A third disadvantage has to do with the control of the computing resource; changes may be forced on the remote user that are either unwelcome or disruptive.

The third alternative, a combination of both local and remote computing facilities, offers a flexible, distributed computing approach which can satisfy a majority of the computing needs of a community college at minimal cost. This alternative provides an economical approach for the initial development of an instructional program on campus through use of remote terminals in that a small initial investment for equipment is required and usage can be managed within available campus funds. Then, as computing utilization builds, it becomes possible to acquire on-campus facilities that operate in an off-line mode such that total computing costs are reduced when compared to strictly the on-line mode.

A campus with computing facilities of the third alternative type can perform the majority of high-volume, introductory-type processing locally, employing the remote host facility when processing requirements exceed the local capabilities.

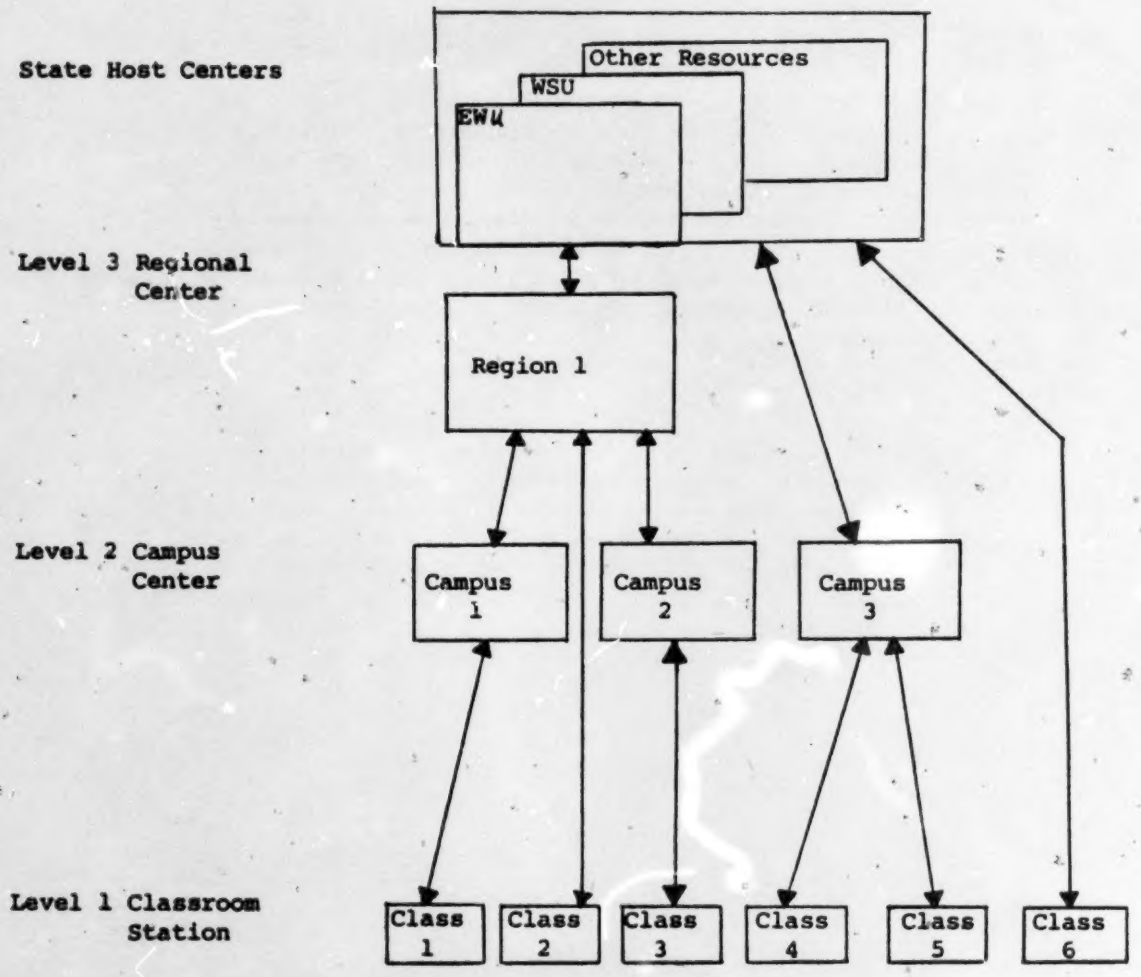
It is appropriate for the community colleges of this state to have computing support delivered by means of a stratified delivery structure that can be visualized as containing three levels. Each institution may have one or more configurations.

Conceived to be an evolutionary process, the implementation of computing support on a campus shall begin with a level 1 facility. Further growth to levels 2 and 3 shall be made on the basis of an orderly process that demonstrates proven ability to effectively and economically employ level 1 and 2 facilities, respectively.

# RESOURCE SPECIFICATIONS AND ACQUISITION PROCEDURES

Current state service centers have sufficient resources to provide the Washington State community college system with hardware and software support for interactive and remote batch processing. Many community colleges are currently utilizing these resources to meet their increasing computing resource needs. However, as volume of processing increases at state service centers, other most cost-effective alternatives may become available to community colleges, such as stand-alone programmable terminals and mini- or micro-computers. The following stratified delivery system describes a coordinated evolutionary growth pattern for individual colleges to consider.

**STRATIFIED DELIVERY SYSTEM**



A. LEVEL 1

At the lowest level of the stratified delivery structure is the classroom station, level 1. Conceptually, level 1 consists of interactive keyboard terminals connected by means of voice-grade telephone lines to a remote host facility, batched remote job-entry terminals, self-contained programmable interactive terminals, micro-computers, data entry devices, or a combination of all five. All colleges will initially acquire, relative to their computing needs, level 1 configurations.

B. LEVEL 2

At the second level of the stratified delivery system is the campus center. The campus center provides in addition to level 1 capabilities, both local and remote interactive computing, plus local and remote batch RJE computing support.

Interactive terminals and data entry devices may be used with local mini-computers or service centers enabling the user to select services required for each course offering. High volume programming activities in the BASIC language, for example, would be available at low cost on campuses with more sophisticated software and application packages available from appropriate state service centers or other sources.

C. LEVEL 3

At the highest level of the stratified delivery system is the regional center, level 3. The regional center provides level 2 capabilities for two or more campuses. Similar in configuration to level 2 facilities, level 3 provides interactive and batch processing (local and remote) for the involved campuses.

PEOPLEWARE

# PEOPLEWARE

Of all the resources necessary to support the curriculum content and curriculum objectives of instructional computing in the community colleges of the state, none is more important than a staff of competent, qualified and well-trained personnel. Without the presence of such people, the best hardware and the best software may be inefficiently utilized. It is safe to conclude that without adequate commitment to a well-trained staff and an ongoing program of personnel development, a college will not achieve maximum benefit and return on its investment in hardware and software. The following sections identify those peopleware resources necessary to support occupational and academic instructional computing activities.

## I. DATA PROCESSING TECHNOLOGY

A versatile, technically competent staff is absolutely essential to a sound community college program in data processing. While providing the faculty with the time and opportunity for growth and skill, the attainment of new skills is critical. Constant study and involvement is necessary if the staff is to avoid stagnation and technical obsolescence and is to keep abreast of new developments.

### A. SPECIFICATIONS

#### 1. Instructional Qualifications

The ideal data processing faculty member at a community college should have at least two years of programming experience, including demonstrated competence on the computing resource that is being used. For example, assembler language instructors should be competent to write programs in the assembler language. Instructors of high-level languages should know at least two high-level languages, and should be aware of special-purpose languages in sufficient detail to be able to discuss types and uses with students. Also, the faculty should be competent in the particular executive or operating/control system installed on the computing resource in use, and should be able to distinguish functions and capabilities of various other systems for students.

Most community colleges will find it difficult to locate faculty with all of these qualifications. As a result, in-service and pre-service training programs are required to help faculty members acquire and update necessary technical skills to teach data processing.

Specific requirements for vocational instructor selection and certification for the State of Washington may be found in WAC 131-16-091 through WAC-131-16-093 of the Standard Policy and Procedures Manual of the SBCCE. Local technical advisory committees may be of assistance to the college in the selection and upgrading of faculty. See "Other Requirements" section for a detailed description of training objectives and resources available.

B. TECHNICAL SUPPORT

Technical support for the occupational programs may include paid paraprofessionals and/or student lab assistants. It is recommended that each college have personnel from these two categories to maintain an adequate computing environment.

Colleges using state host facilities must have the support of host center personnel in order to adequately utilize the facilities.

Cooperative work experience programs must have professional staff assigned to this activity on a paid or released-time basis.

Preferably, a full-time person should be placed in this position if enrollment levels are sufficient.

## II. ACADEMIC INSTRUCTIONAL COMPUTING

Although academic computing does not require that the instructor be a professional programmer or computer technician, as is the case for the occupational data processing technology curriculum, it is nevertheless essential that academic instructors have experience and knowledge of the applications or languages being taught. Clearly, one cannot effectively teach what one does not know. However, experience and knowledge in computing and programming is at best difficult to obtain for the faculty member faced with incorporating computing support into his classes. In-service training, released-time programs, and seminars can go a long way to fill the need for a faculty knowledgeable of the role and technology of computing in academic instruction.

This section defines the peopleware skills and capabilities needed by faculty engaged in teaching courses that utilize computers and computing technology.

A. GENERAL INTRODUCTION TO COMPUTING COURSES

The faculty member teaching a course of this type needs extensive general knowledge of computers, data processing, and automation. This requisite knowledge needs to be broad and somewhat philosophical. Specific technical expertise is not as crucial as a good conceptual knowledge of historical aspects of computers, computer applications, architecture of computational tools, roles and impacts of computing on society, and prospects for the future in computing and automation.

B. PROBLEM SOLVING AND LANGUAGE COURSES

Here the faculty member should be a qualified person capable of not only teaching the subject matter area but also the use of the language, languages, or application programs involved. He should have an operational knowledge of the use of the campus computing facilities supporting his course content.

C. CAI, CMI, CBI

Peopleware support for CAI requires that the instructor be able to develop new or utilize existing CAI software/hardware packages.

To be able to use, prepare and/or modify CAI materials, individual instructors must be trained in the authoring language available to them. This training will require that seminars be held and may require released time for the instruction of the language.

Technical staff support must be available both at the campus center and at the host computer center to handle problems that develop.

Peopleware support required to utilize an existing CMI system implemented on an existing state host includes a knowledgeable instructor familiar with terminal operation and access to host facilities as necessary, assuming the instructor already knows the characteristics of the CMI package selected.

To develop a CMI package, programmers, keypunch/clerical personnel, and an instructor for the subject matter to be supported by the CMI system so developed should be available.

CBI, like problem solving and language areas, requires an instructor with knowledge and skills in utilizing CBI applications. This involves experience in the use of computing resources, familiarity with software support programs, and competency in applying CBI applications to courses being taught. An instructor should have some prior experience in using CBI applications before engaging in such activities in the classroom.

D. COMPUTER SCIENCE

The computer science instructor, like his data processing technology counterpart, should be a computing professional with recognized academic credentials.

# OTHER REQUIREMENTS

Other areas of need in meeting instructional computing requirements are briefly discussed in this section. Areas covered include personnel development, instructional aids, and facilities.

## I. PERSONNEL DEVELOPMENT

Continuing on-the-job training is essential for all instructional staff members. Data processing technology instructors must be aware and knowledgeable of new developments in computing technology and applications in order to make judgments as to how, when, and where these new concepts are to be integrated into the curriculum. Theoretical knowledge and practical experience of both equipment and techniques is required. Academic instructors, too, need exposure to new developments and techniques in their areas of instructional computing.

Major sources of knowledge on programming techniques and applications are professional journals, seminars, conferences, and in-service training programs. Other sources of information are specialized summer institutes, senior college programs, and manufacturer or vendor schools. An implication to consider is the fact that instructional personnel in computer technology have very few senior institutions in which to pursue additional training in certain required skills. Although systems training and other skills in computing science are offered, these areas are not geared to the level of instruction in community college programs. Consideration, therefore, must be given to released time for instructors to obtain training in vendor schools, technical seminars, independent study, or on-the-job experience.

### A. IN-SERVICE EDUCATION

In-service training for faculty members is an essential component for on-going success of instructional computing. Reference here is not simply to faculty members who are directly involved with data processing technology instruction, or even simply to faculty members in disciplines which have traditionally demonstrated the highest interest level in the use of the computer in instruction (i.e., science and mathematics). Colleges must be willing to spend resources and to plan carefully for the education of faculty members in all disciplines and occupational programs in order to foster an awareness

of what the computer can do, how it works, what it cannot do, how it is misused, and how to use this technological development in a human environment. There is no learning experience which could not, in some conceivable way, be assisted by a computer. (Not all such conceptions would be practically feasible. Nevertheless, the range of practical applications considerably exceeds those permitted by stereotypes and inhibitions which tend now to limit faculty thinking about the use of the computer.)

The plan for in-service training should include sufficient support and hardware capabilities to allow faculty members the time to experiment and "play" with the computer in a direct real-time environment.

There is currently available from the Department of Personnel Interagency Training Division a complete inventory of audio-visual tapes on data processing. The tapes are available at no cost and address a wide variety of subjects such as computing systems, fundamentals, teleprocessing concepts, FORTRAN IV, DOS, OS, data base concepts, simulation, project management and many more. A complete, current listing of the courses and how to obtain them can be obtained by writing to the Department of Personnel, Interagency Training Division, 910 East Fifth, Olympia, Washington (98504).

B. IN-SERVICE TRAINING OBJECTIVES

1. The provision of in-service training for faculty and staff, the availability of ideas and help for those interested in using the computer as a teaching/learning tool.

2. The improvement of instructor proficiency through the monitoring of student progress data.

3. The conduction of pilot projects involving the use of computers which will enhance the instructional programs.

4. The development of a library of CAI, CMI, CBI and problem-solving applications and documentation.

5. The evaluation of video-tape and programmed instruction course usage to assist instructors in teaching problem-solving languages.

6. The conduction of periodic workshops wherein computer-oriented teaching ideas can be exchanged and developed.

7. The development or adoption of computer-assisted, computer managed, and computer-based instruction modules for demonstration purposes.

8. The orientation of instructors to the many different areas in which the computer can be applied to help solve a problem.

9. The development of an in-service educational package that will provide enough experiences for instructors to better understand the comparable problem-solving capabilities and how they might be used in better teaching his/her subject.

10. The provision of college-credit courses for faculty on the effective uses of computer-supported instruction.

11. The provision of staff release time for program development.

12. The development of a suggested instructor profile including self-improvement opportunities and desired qualifications.

## II. INSTRUCTIONAL AIDS

Various mediums and information resources are desirable in addition to lectures, textbooks, and computing equipment. Some of these may be prepared by individual instructors, although in many cases professionally-prepared materials are available. This section briefly addresses those media.

A. Audio-visual

B. Transparencies

C. Filmstrips, prepared type

D. Movie films

E. Video-tape

F. 35 mm slides

G. Audio-tape lectures

H. Synchronized sound projector/viewer lectures

I. Terminal lectures or lessons

J. Microfiche

K. Simulators and simulation models

## III. FACILITIES

Physical planning for facilities consists of providing for adequate student and staff work space, plus providing for location of computing equipment. Vendor specifications must be considered when installing equipment for each of the three levels of delivery system.

# RESOURCE SPECIFICATIONS AND ACQUISITION PROCEDURES

In order to support the activities described in the preceding sections of this document, many of the community colleges will desire new or additional equipment and access to appropriate software support. Computing equipment for a given college should be acquired in a phased growth manner with the amount of computing resources reflecting the experience and growth of instructional computing on campus.

## I. ACQUISITION PROCEDURES

The process of acquiring computing resources consists of five general steps: (1) defining the campus' instructional needs, (2) developing alternatives to satisfy those needs, (3) selecting the best alternative, (4) receiving the necessary approvals, and (5) selection of the equipment.

The first step is to define the campus instructional needs. This involves the completion of the appropriate documents (See Section IV) - Class Profile (page 119) Requirements Summary (page 120) Alternative Cost Analysis (page 121) and Alternative Cost Summary (page 122). The appropriate documentation is dependent upon the campus' location within the stratified delivery system. For a complete description of the recommended information, see the detailed section on each level.

The second step is to determine various alternative methods to meet the defined needs. The alternatives considered will again be dependent upon the campus position within the stratified delivery system.

Step three is the selection of the best alternative. Some of the factors which should be considered are: meeting defined needs, cost, and a means for future growth.

There are essentially three levels of approval which are necessary before ADP equipment is acquired: (1) institutional, (2) State Board for Community College Education, and (3) Data Processing Authority. Institutional approval includes appropriate expenditure approval and appropriate instructional program approval.

Institutions may request ADP equipment by submitting the appropriate documentation to the State Board Office. The State Board for Community College Education acts as a liaison between the colleges and the Data Processing Authority. Thus, any equipment which requires DPA approval will be reviewed by the SBCCE within the framework of community college computing plans

and State Board policies. Approval requests and recommendations will be referred to the Data Processing Authority.

Under state ADP Policy PO.02.010, all equipment, except stand-alone devices limited to keyboard or voice entry with output not suitable as an entry vehicle into digital or analog computers (e.g., desk calculator, tape record) must be approved by the DPA before they are acquired. The Data Processing Authority reviews the individual plans within the context of its approved data processing plans and its existing policies and guidelines.

The Data Processing Authority will also work closely with the requesting campus to aid them in the formal equipment acquisition procedure. The requesting campus may choose to acquire its equipment from an existing state contract; if so, the DPA will place the order. Otherwise, the DPA will work with the campus on a competitive acquisition.

A competitive acquisition involves the development of detailed functional equipment specifications for a request for proposal (RFP). This RFP is sent to the vendors. The vendors develop their proposals and submit them to the Data Processing Authority. The proposals will then be evaluated by the requesting agency with assistance from the DPA. After the apparent successful vendor is selected, a finalized contract will be negotiated by the DPA with the vendor. Upon completion of the negotiation process, the DPA will authorize the requesting institution to proceed with the acquisition.

## II. SOFTWARE ACQUISITION AND MAINTENANCE

Computer software for instructional computing will be provided for the community colleges primarily by host computer center facilities. Access to host software will be via telephone lines and remote terminals. For those campus facilities that are local and/or self-contained, vendor-supplied software may be acquired in accordance with the procedures and forms in Section IV. Development of software and application packages may be undertaken at the local campus level for specific instructional objectives. There exists a number of resources within the state host centers, other four-year and two-year colleges, and various state agencies to aid colleges in the development and maintenance of necessary software.

However, coordination of available and existent software and application packages will encourage the most efficient and economical use of these resources. Currently, there is no body, committee, or commission charged with the coordination,

dissemination, acquisition, and maintenance of community college software, It is a recommendation of this plan that some form of coordinating body be established to perform the aforementioned tasks. Otherwise, software acquisition, development, and maintenance will necessarily remain at the campus level where visibility may be low, redundancy high, and costs to the state less than optimum.

## III. PEOPLEWARE ACQUISITION

Acquisition of personnel is a local campus responsibility and should be consistent with the aforementioned technical qualifications and competencies. However, the coordinating body mentioned in the previous section could be instrumental in establishing recommendations, guidelines, and practices in the area of personnel development.

## IV. CRITERIA FOR ENTRY INTO AND MOVEMENT WITHIN THE STRATIFIED DELIVERY STRUCTURE

Initially, a college will enter the instructional computing environment at level 1. The following criteria establishes the steps and requirements to move from level 1 to level 2 and from level 2 to level 3. Establishing the various criteria includes analysis of: (1) individual classes, (2) overall requirements, and (3) cost alternatives. Example formats for each of these analyses are on the pages following the criteria descriptions.

A. LEVEL 1 CRITERIA (Interactive terminal to remote service center)

1. Desire/interest by instructor for use of computing capabilities in one or more instructional areas expressed by class profiles and a letter to the State Board for Community College Education. The letter should include designation of host site, dollar cost, and source of funds.

2. Demonstrated instructional computing resource requirements analysis to include:

   a. Class profiles to identify need for computing support for each instructional program;

   b. Requirements summary which shows current level of computing activity and projected use over four years;

c. Alternative cost analysis to show detailed current and four-year projected costs associated with each alternative; and,

d. Alternative cost summary to show comparison of total costs for each alternative on a prorated basis over four years.

3. Sufficient level of planned processing over a four-year period to justify selected alternative.

4. Budget commitment and approval by local administration.

5. Approval by State Board and Data Processing Authority is required.

B. LEVEL 2 CRITERIA (Campus center)

1. Demonstrated institutional and staff experience in Level 1 type computing activities.

2. Hardware compatibility with state centers, regional centers, and other campus sites.

3. Software compatibility with state centers, regional centers, and other campus sites.

4. Identified staff support by the institution for the campus center (recommended one full-time staff as a minimum).

5. Instructional computing resource requirements analysis.

6. Sufficient level of planned processing over a four-year period to justify selected alternative.

7. Budget commitment and approval by local administration.

8. Approval by State Board and Data Processing Authority is required.

C. LEVEL 3 CRITERIA (Regional centers)

1. The primary basis for establishing regional centers will be improved level of service and cost savings.

2. Institutions wishing to establish a regional instructional computing center should use DPA

standards for service center operations as guidelines.

3. A formal cooperative agreement must be agreed to by all participating schools in the regional center.

4. Hardware and software compatibility with state service centers and other regional centers will be required.

5. An instructional computing resource requirements analysis will be required.

6. Budget commitments and approval by local districts will be required.

7. Approval by State Board and Data Processing Authority will be required.

## EXAMPLE OF CLASS PROFILE

1. Course Title: Math 115 Introduction to Computer Programming

2. Course Objective: Programming and coding of problems for digital computers; flowcharts, loops and subroutines

3. Number of quarters per year course offered: Four Quarters

4. Current Computing Facilities: The Evergreen State College

5. Course Content:

### STUDENT ASSIGNMENT PROFILE
(This is an example of one possible course.)

| Software | Prog. Assgnt. | Description | Mode | Run 1 | Run 2 | Run 3 | Run 4 | Run 5 | Time/ Minutes |
|---|---|---|---|---|---|---|---|---|---|
| BASIC | 1 | Hardware Familiarization | Batch | 100% 5"/S* | 50% 5"/S | 17% 5"/S | | | |
| BASIC | 2 | Loop & Counters | Batch | 100% 10"/S | 90% 10"/S | 50% 15"/S | 17% 15"/S | | |
| BASIC | 3 | Automatic Looping Print Format | Batch | 100% 10"/S | 90% 10"/S | 50% 15"/S | 17% 15"/S | | |
| BASIC | 4 | List Dimension | Batch | 100% 10"/S | 90% 10"/S | 50% 15"/S | 17% 15"/S | | |
| BASIC | 5 | Two Dimension Array Subroutines | Batch | 100% 10"/S | 100% 15"/S | 67% 20"/S | 33% 20"/S | 17% 25"/S | |
| FORTRAN | 6 | | Batch | 100% 20"/S | 100% 20"/S | 33% 20"/S | 17% 20"/S | | |

*Five minutes per student

| | (History) | | | (Projected) | | | | 4-Year |
|---|---|---|---|---|---|---|---|---|
| | Year 1 | Year 2 | Current | Year 1 | Year 2 | Year 3 | Year 4 | Total |
| No. of students | 82 | 90 | 90 | 90 | 90 | 90 | 90 | 360 |
| No. of hours | | | | | | | | |

(Current year amount determined by profile above. Projected based upon current year data.)

EXAMPLE OF OVERALL REQUIREMENTS SUMMARY
(Processing Hours)

| Classes | Year 1 | Year 2 | Current | Year 1 | Year 2 | Year 3 | Year 4 | 4-Year Total | % Dist. |
|---|---|---|---|---|---|---|---|---|---|
| Totals from Class Profiles | | | | | | | | | |
| Math | | | | | | | | | |
| DP | | | | | | | | | |
| Acctg. | | | | | | | | | |
| Sub-Total | | | | | | | | | |
| Non-Class Needs | | | | | | | | | |
| In-Serv. Training | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| Total No. of Processing Hrs. | | | | | | | | | |
| Functional Requirements - Software | | | | | | | | | |
| BASIC | | | | | | | | | |
| FORTRAN | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| Total | | | | | | | | | 100% |
| Non-Instructional Requirements | | | | | | | | | |
| Admin. | | | | | | | | | |
| FINAL TOTAL IN NO. OF HOURS | | | | | | | | | |

EXAMPLE OF ALTERNATE COST ANALYSIS

| COST ITEM | ONE TIME (Purchased) | REOCCURRING (Operating) Year 1 | Year 2 | Year 3 | Year 4 | TOTAL 4-YEAR COST |
|---|---|---|---|---|---|---|
| Computer | | | | | | |
| Mainframe | ($ ) | | | | | ($ ) |
| Printer | ( ) | | | | | ( ) |
| Reader | ( ) | | | | | ( ) |
| Maintenance | ( ) | ($ ) | ($ ) | ($ ) | ($ ) | ( ) |
| Terminals | | | | | | |
| Terminal 1 | ( ) | | | | | ( ) |
| Terminal 2 | ( ) | | | | | ( ) |
| Maintenance | | ( ) | ( ) | ( ) | ( ) | |
| Communications | | | | | | |
| Lines | | ( ) | ( ) | ( ) | ( ) | ( ) |
| Interface | ( ) | | | | | ( ) |
| Coupler | ( ) | | | | | ( ) |
| Portable Phone | ( ) | | | | | ( ) |
| Other Equipment | | | | | | |
| IBM Key Punch | ( ) | | | | | ( ) |
| Software | | | | | | |
| FORTRAN | ( ) | | | | | ( ) |
| Time Sharing Services | | | | | | |
| CWU | | ( ) | ( ) | ( ) | ( ) | ( ) |
| Support | | | | | | |
| Staff | | | | | | |
| Facilities | | | | | | |
| Supplies | | ( ) | ( ) | ( ) | ( ) | ( ) |
| FINAL TOTAL | ($ ) | ($ ) | ($ ) | ($ ) | ($ ) | ($ ) |

EXAMPLE OF ALTERNATIVE COST SUMMARY

(All amounts are for a four-year period.)

CURRENT OPERATING PROCEDURE

| | | |
|---|---|---|
| Terminals (off-line) | ($ ) | |
| Terminals (on-line) | ( ) | |
| Time Sharing | ( ) | |
| Supplies | ( ) | |
| Telephone Lines | ( ) | |
| TOTAL OPERATING COST | | ($ ) |

ALTERNATIVE I (with enhancements over existing)

| | | |
|---|---|---|
| Total Cost of Alternative | | ($ ) |
| Residual Value: | | |
| Equipment to be amortized: | | |
| a. Computer | ($ ) | |
| b. Terminals | ( ) | |
| c. Communications | ( ) | |
| | ( ) | |
| 25% Residual Value | | ( ) |
| TOTAL NET COST | | ($ ) |

Advantages

Disadvantages

ALTERNATIVE II

(Repeat same information as for ALTERNATIVE I)

## GLOSSARY OF TERMS

Batch Processing: An approach to processing data where a number of input items are grouped for processing during the same machine run. Contrasted with on-line processing.

Computer Generations: Refers to the technological changes in manufacturing computer equipment which result in new models of machines with increased capacity, new capabilities, and generally lower cost for volume of work produced.

Computer Program: A set of logically arranged instructions to cause the computer to perform its various functions of data input, processing, and data output.

Computer Programming Language: A symbolic or English language designed to communicate problem instructions to the computer. Common languages include COBOL, FORTRAN, PL 1, and Assembler language.

Computer Systems: A network of interconnected machines consisting of a central processing unit, data input units such as card readers, data storage devices such as magnetic tape units, and data output devices such as printers.

Data Files: A collection of related items of data treated as a unit. Example: A student ID number is an item of data as is a course grade, home address, etc. Collectively, these items form a record for each student - the individual records of all students form a data file.

Data Processing System: A network of machines and procedures capable of accepting data, processing it according to a plan, and producing the desired information results.

Hardware: The physical machines which comprise a computer system. Contrasted with software.

Information Science: A field of study devoted to applying computers to the problems of information needs, collecting and processing information, and preparing information for decision-making. Typically includes advanced techniques of operations research, computer modeling and simulation of business processes, and numerical analysis.

Information Systems: A combination of data files, computer programs, and procedures to collect, process, store, retrieve, and disseminate various operating reports and analysis for use by administrators, boards of education, and teaching faculty.

Numerical Analysis: The study of methods of obtaining quantitative solutions to problems in which the elements of the problem can be expressed in mathematical relationships.

Numerical Control: A field of computer applications which center around the control of machine tools by computer programming.

On-Line Processing: A system (using remote terminals) in which data is sent to the computer and/or retrieved at the time and place most advantageous to the user. Contrasted with batch processing.

Remote Terminals: Devices for data input and retrieval to and from a computer. A device is located at some distance from the computer system and may be connected to the computer via a telephone communications system or by direct cable.

Software: The computer programs as prepared by either the manufacturer or the user to control the functions of a computer system. Contrasted with hardware.

System Analysis: The study and analysis of an administrative activity to determine the processes, procedures, sources of data, and elements of information that are necessary to accomplish the purpose of the activity.

Peopleware: The staff and personnel necessary to operate the hardware, software, and instructional systems used in instruction.

Time-sharing: The simultaneous, multiple use of a computer devise by two or more users, usually via terminals in an on-line teleprocessing environment.

Terminal: Any of a wide variety of typically key-driven computing devices that are connected to a remote computer by telephone lines.

Host Computer: Any of a wide variety of computing devices capable of providing computational and data processing support to remote terminals.

Programmable Terminal: A product of recent developments in computer terminal technology that provides both off-line and on-line computing activities through the same terminal-type device. Usually, programmable terminals can be used in a wider variety of applications and with greater versatility than standard, typical computer terminals.

Off-Line Computing: The use of stand-alone, dedicated computing resources that are not connected to a host computer through telecommunication lines.

Computer Simulation Model: A mathematical model of a real system or environment that is programmed for and operated on a computer in order to simulate the real system or environment so that it may be studied and analyzed.

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## WASHINGTON COMMUNITY COLLEGE SYSTEM

*INSTRUCTIONAL COMPUTING: RESOURCE UTILIZATION*

| COMMUNITY COLLEGE | ANNUAL FTE STUDENTS 1976-77 | ON-SITE COMPUTING DEVICES | | | | HI-SPEED RJE'S | | LO-SPEED TERMINALS | | DATA ENTRY | UNIT RECORD | FY 1978 EQUIPMENT & SERVICES BUDGET |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Maxi | Mini | Micro | Programmable Calculator | Quantity | Host(s) | Quantity | Host(s) | | | |
| PENINSULA | 1,142 | -- | -- | -- | 1 | -- | -- | 1 | TWICS | -- | -- | $ 3,000 |
| GRAYS HARBOR | 1,363 | -- | -- | -- | 1 | 1 | WSUCC | -- | -- | 7 | -- | 19,219 |
| OLYMPIC | 3,605 | -- | -- | -- | 1 | 1 | WSUCC | 2 | TESC | 10 | 1 | 33,886 |
| SKAGIT VALLEY | 2,565 | 2 | 2 | 3 | -- | -- | -- | 5 | LOCAL | -- | -- | 6,100 |
| EVERETT | 4,207 | -- | -- | 1 | -- | -- | -- | 8 | ESD 189 | -- | -- | 13,912 |
| EDMONDS | 2,483 | 1 | 1 | 1 | -- | -- | -- | 6 | LOCAL | 1 | -- | 3,400 |
| SEATTLE CENTRAL | 5,740 | -- | 1(2) | -- | -- | 1(2) | WSUCC | 10 | LOCAL | 24 | 5 | 26,066 |
| NORTH SEATTLE | 3,540 | 1 | -- | 10 | -- | -- | -- | 20 | LOCAL | 1 | -- | 8,500 |
| SOUTH SEATTLE | 2,637 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| SHORELINE | 4,745 | -- | 1 | -- | 1 | -- | -- | 12 | LOCAL | -- | -- | 760 |
| BELLEVUE | 4,125 | -- | -- | -- | 1 | -- | -- | 5 | LOCAL | -- | -- | 8,500 |
| HIGHLINE | 4,559 | 1 | -- | -- | -- | -- | -- | 6 | LOCAL | 13 | 4 | 49,896(1) |
| GREEN RIVER | 3,765 | -- | -- | -- | -- | -- | -- | 5 | TESC, WSU | -- | -- | 5,200 |
| FORT STEILACOOM | 5,659 | -- | -- | 1 | -- | 1 | WSUCC | 2 | WSU | 4 | 1 | 12,240 |
| CENTRALIA | 1,963 | -- | -- | -- | -- | -- | -- | 2 | TESC | 11 | -- | 35,276 |
| OTCC | 1,423 | 1(2) | -- | -- | -- | 1(2) | WSUCC | 4 | WSU, TESC | 16 | -- | 82,328 |
| GARRETT HEYNS | 426 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1,800 |
| LOWER COLUMBIA | 2,167 | -- | -- | 2 | -- | 2 | WSUCC | 14 | TESC, TWICS | 11 | -- | 24,892 |
| CLARK | 3,628 | 2 | 1 | 1 | -- | -- | -- | 18 | LOCAL | 15 | 4 | 26,100(1) |
| WENATCHEE VALLEY | 1,903 | -- | -- | -- | -- | -- | -- | 1 | WSU | -- | -- | 2,740 |
| YAKIMA VALLEY | 3,118 | -- | -- | -- | -- | 1 | WSUCC | -- | -- | 1 | 2 | 300 |
| SPOKANE | 5,954 | 1 | 1 | -- | -- | -- | -- | 1 | LOCAL, TWICS | 28 | 3 | 43,160 |
| SPOKANE FALLS | 5,951 | -- | -- | -- | -- | -- | -- | 2 | LOCAL,TWICS,WSU,TESC | -- | -- | 12,000 |
| BIG BEND | 1,106 | -- | -- | 1 | -- | 1 | WSUCC | 1 | LOCAL | 4 | -- | 16,000 |
| COLUMBIA BASIN | 2,762 | 1 | -- | -- | -- | -- | -- | 1 | TWICS | 5 | 4 | 58,500(1) |
| WALLA WALLA | 2,652 | -- | -- | -- | -- | -- | -- | -- | -- | 2 | -- | -- |
| WHATCOM | 813 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| TACOMA | 3,892 | -- | -- | -- | 1 | -- | -- | 6 | WSU, TWICS | 6 | -- | 17,266 |

(1) *Includes some administrative work*

(2) *Same piece of equipment in two categories*

TWICS: The Washington Interactive Computer Services at Eastern Washington University
TESC: The Evergreen State College Computer Center
WSU: Washington State University Computer Center

| | DATA PROCESSING TECHNOLOGY | | | | DP Introduction or Survey | Computer Science | Problem Solving | Approved Vocational Program? |
|---|---|---|---|---|---|---|---|---|
| | Analyst/ Programming | Mini/Micro Computing | Operations | Data Entry | | | | |
| PENINSULA | -- | -- | -- | -- | 2 | -- | 1 | no |
| GRAYS HARBOR | 4 | -- | -- | 1 | 1 | -- | 1 | yes |
| OLYMPIC | 10 | -- | -- | 1 | 1 | -- | -- | yes |
| SKAGIT VALLEY | -- | -- | -- | -- | 1 | 5 | 4 | no |
| EVERETT | 14 | -- | -- | 1 | 1 | -- | 2 | yes |
| EDMONDS | -- | 4 | -- | -- | 1 | -- | 7 | no |
| SEATTLE CENTRAL | 16 | -- | 3 | 4 | 1 | -- | -- | yes |
| SEATTLE NORTH | 17 | -- | -- | -- | 1 | -- | -- | yes |
| SEATTLE SOUTH | -- | -- | -- | -- | 1 | -- | -- | no |
| SHORELINE | -- | -- | -- | -- | 1 | -- | 4 | no |
| BELLEVUE | -- | -- | -- | -- | -- | -- | 3 | no |
| HIGHLINE | 12 | -- | 1 | 2 | 3 | -- | -- | yes |
| GREEN RIVER | 2 | -- | -- | -- | 1 | -- | 1 | no |
| FORT STEILACOOM | 12 | -- | -- | -- | 2 | 2 | -- | yes |
| CENTRALIA | 3 | -- | -- | 1 | -- | -- | 2 | no |
| OTCC | 6 | -- | 1 | -- | 1 | -- | 2 | yes |
| GARRETT HEYNS | 3 | -- | -- | -- | -- | -- | -- | no |
| LOWER COLUMBIA | 13 | 1 | -- | 1 | 2 | -- | 1 | yes |
| CLARK | 21 | -- | 1 | 2 | 3 | 5 | -- | yes |
| WENATCHEE VALLEY | -- | -- | -- | -- | 1 | -- | 3 | no |
| YAKIMA VALLEY | -- | -- | -- | -- | 1 | -- | 2 | no |
| SPOKANE | 12 | -- | 1 | 7 | 2 | -- | -- | yes |
| SPOKANE FALLS | -- | -- | -- | -- | 1 | -- | 3 | no |
| BIG BEND | 8 | 1 | -- | 1 | 2 | 2 | -- | yes |
| COLUMBIA BASIN | 7 | -- | -- | -- | 2 | -- | 2 | yes |
| WALLA WALLA | -- | -- | -- | 3 | 1 | -- | -- | no |
| WHATCOM | -- | -- | -- | -- | 1 | -- | -- | no |
| TACOMA | -- | -- | -- | 1 | 1 | -- | 3 | no |

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LOS ANGELES
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